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The Surveyor

And Municipal and County Engineer.

VOL. L.

JULY 7 TO DECEMBER 29, 1916.

143365
10/7/17

London:
THE ST. BRIDE'S PRESS, LTD.,
ST. BRIDE'S HOUSE, 24 BRIDE LANE,
FLEET STREET, E.C.

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The Surveyor

And Municipal and County Engineer.

Vol. L. JULY 7, 1916. No. 1,277.

Minutes of Proceedings.

The Alignment Diagram Applied to Water Mains.

In the present state of our knowledge the engineer has to learn at an early stage that theory is not always in accordance with practice. Experience rather than theory is our guide in many matters, and the world abounds in examples of structures which are apparently lacking in stability, by all the accepted rules, and which nevertheless serve their purpose satisfactorily, and with others which have to be made far stronger than plain theory would lead us to expect. The knowledge that our theory is incomplete and does not take all the facts of the case into account helps us very little, and merely shows the need for a great deal of work based upon an endless series of experiments and observations. Every work and discussion which has for its object the advancement of our knowledge of theoretical matters is to be welcomed, particularly when it results in something tangible which will be of immediate use to the engineer in his daily work.

Hydraulic calculations are certainly among the most satisfactory work that an engineer is called upon to do. It is both interesting and pleasant to calculate the discharge of a main or series of mains and to be able to check the result by actual measurement, to find that the expected volume of water is delivered, that an exact pressure is obtained, and that the jet of water thrown by a certain hydrant reaches a certain expected level. If such results are obtained, one is tempted to think that here at least theory is very complete. One has only to study an ordinary text-book, however, to be surprised at the number of formulæ giving different results and to examine the record of experiments made of the flow of water through mains in ordinary practice to see that there are a very large number of factors such as corrosion and incrustation which may soon upset any ordinary calculation, while the variety of possibilities in a complicated system will often present a problem the solution of which is by no means easy. The water engineer has therefore to guard against any assumption that the rules which were applied to any one case satisfactorily will necessarily apply to another. Where such calculations have to be made the water engineer generally uses a diagram of one kind or another showing the rate of flow, the diameter of the pipe, and the hydraulic gradient.

Mr. D. Halton Thomson, in an excellent paper read before the Institution of Water Engineers, brings forward an amplification of the diagram method which should certainly be very useful. The paper was published in these pages in our last issue, and shows how the alignment diagram may be applied to the flow of water in uniform and in compound mains. The author does not claim to have introduced this application of the alignment diagram, though the matter does not appear to have been brought very prominently before water engineers before. He has, however, done this, and he has extended its use to compound mains, giving us at once something which was much needed; for, while it is a fairly simple matter to deal with the problem presented by a simple main, it is always rather a long and tedious matter to work out the discharge from a series of mains of varying diameters. The extension is made possible by taking advantage of the principle that any combination of mains may be replaced by a single imaginary equivalent main of the same discharge and loss of head. A diagram is constructed having six vertical parallel axes, five of which represent the variables of pipe flow given in the general formula for flow of water in pipes, and the remaining axis is that of "carrying power," which is of use in comparing single uniform mains and in calculating the flow in compound mains. In this diagram the law of the scales and their relative magnitude and position are such that when any straight line is drawn across them the points of intersection on each of the scales will be such that if any two variables on a system are known the line drawn through them will cut the scale of the third variable at its corresponding value. Thus by merely drawing lines or applying a straight-edge to the diagram the unknown quantity, be it discharge, diameter, carrying power, hydraulic gradient, loss of head or length, may at once be found. The author explains the use of his diagram very clearly by means of examples, and very little study of the paper will enable the engineer to test its value. It is necessary to note that the diagram is based upon the use of certain constants, depending on the internal condition of the pipes, and that these apply to uncoated cast-iron pipes the internal condition of which causes, for any given rate of discharge, a loss of head about 30 per cent greater than that in new pipes. The adoption of such constants will not apply to all cases.

* * *

Civic Study in Civic Design.

Prof. Abercrombie has done so much for the promotion of town planning, both as a lecturer at Liverpool University and as editor of the *Town Planning Review*, that anything he has to say on this important branch of municipal work is entitled to careful consideration. In his paper on "Civic Study in Civic Design," read at the annual meeting of the Institution of Municipal and

County Engineers at Blackpool, he commenced by tilting at our national habit of embarking on great undertakings without adequate preparation, and no one will dispute that, however successful we may eventually be, our habit of "muddling through" is costly and wanting in method. While, however, we have on the one hand complaints that we are undertaking town planning schemes without proper study and preparation, on the other hand we have demands made that, despite this want of study, town planning should be made obligatory. Town planning has not been so long the fashion, and the times are so much out of joint for the preparation of schemes that we should not be unduly perturbed that our councils are not able to keep pace with these enthusiastic civic reformers, or that the demand for war economy should prevent them going in for extensive schemes. There will be general agreement with Prof. Abercrombie's ideas as to the methods of study to be adopted by those who have to prepare a town planning scheme. As Prof. Abercrombie admits, these methods are usually, if unconsciously, adopted by town planners, and with satisfactory results, but a satisfactory result can only be obtained where the designer has an intimate knowledge of the district he is planning or has obtained the requisite data by means of a formal civic survey.

The need for being able to control the planning in the outlying districts of our large towns was emphasised in the course of the discussion by Mr. Stilgoe, who has found the area of 43,000 acres in Birmingham insufficient for the proper development of his arterial roads. It is now very generally admitted that it is of little use planning a wide arterial road within a borough, or two neighbouring boroughs, if the adjoining districts will not come into line and widen their roads in accordance with a comprehensive traffic scheme. A comprehensive plan which will embrace a number of neighbouring districts is particularly desirable for traffic purposes, and in many cases it ought to include the provision of open spaces, water supply, and sewage disposal, instead of allowing a large number of small local schemes. That a large general plan on these lines should be prepared being admitted, there remains the question as to who is to prepare it. Prof. Abercrombie, as an architect, naturally favours the example of the London society, or commissioners such as those appointed at Chicago and Ottawa, in which the leading spirits are architects and business men, and the municipal engineer is relegated to a back seat. That municipal engineers will be content to accept such an undignified position can hardly be expected when one remembers the pioneer work done by such men as Mr. Brodie at Liverpool, Mr. Stilgoe at Birmingham, and Mr. Thomson at Dundee. As Mr. Shawcross pointed out in the opening of his paper, the planning of roads will always be the most important practical part of a scheme, and this is essentially the work of the engineer, and the nation will have to rely for its town planning schemes more on the engineer than the architect. Both engineer and architect have their proper place in town planning schemes, but it is the engineer who will have to prepare the general layout, and the architect must develop and clothe the framework provided by the engineer by designing the national, municipal and other buildings which so largely give dignity and character to our towns and cities.

* * *

House Drainage.

An interesting case which was heard recently in the High Court raised a question as to the power of a local authority to enforce the drainage of a house under sec. 23 of the Public Health Act, 1875. It will be remembered that that section provides that where any house within the district of a local authority is without a drain sufficient for effectual drainage, the local authority shall by written notice require the owner or occupier of the house to make a covered drain emptying into any sewer which the local authority are entitled to use which is not more than 100 ft. away, but that if there is no sewer within that distance, then emptying into such covered cesspool or other place not being under any house as the local authority may direct. The question raised by the case *(The Chelmsford Corporation* v. *Bradridge)* was as to whether, in the absence of a sewer within the prescribed distance, the power of the local authority to enforce drainage is limited to cases where there is an existing cesspool, or whether they can enforce the construction of a new cesspool if that be necessary. The respondent Bradridge was the owner and occupier of Springfield Mill, and a notice was served upon him requiring him to make a covered drain emptying into a covered cesspool in pursuance of sec. 23. He failed to comply with the requirements of the notice, and thereupon the work was executed by the corporation and he was summoned for the recovery of the expenses. The justices before whom the case was originally heard dismissed the summons, and the corporation now appealed. The appeal was allowed, the judges being unanimous in deciding that the powers of a local authority under sec. 23 are not confined to the case where there is an available covered cesspool in existence, but that they may give notice to the owner of the house requiring him to make the covered drain emptying into a covered cesspool to be constructed, and, upon his failure to comply with the notice, may themselves construct a covered drain and covered cesspool and recover from him the cost of so doing. Although the Public Health Act was passed so long ago as 1875, the point decided in this case appears to be an entirely novel one. As Mr. Justice Avery pointed out, if the decision of the justices had been allowed to stand the result would have been that in a large class of cases the powers conferred by sec. 23 to enforce the drainage of premises in the interests of the public health would have been reduced to a nullity. The decision is one of great importance to sanitary authorities, and should be noted by surveyors.

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Parliament and Charing Cross Bridge.

The rejection of the railway Bill for the strengthening of Charing Cross Bridge did not come as a surprise, for happily the way had been well prepared by a volume of informed protest to which it is only reasonable Parliament should pay due attention. There can be no question about the ugliness of the bridge, nor need the point be laboured that the Charing Cross site with its over-congestion is a defacement of one of the most important parts of London. Nothing less worthy of an historic spot, with its teeming railway station and its sordid appendage in bridge form, could well be imagined, and we are forced to the conclusion of Mr. John Burns that if the nation had possessed some public department akin to a Ministry of Art such a Bill as that presented to the House of Commons on Monday last would have been impossible. The alternative to the existing régime is to deal with the site in a manner worthy of London's architectural future, and we note in this connection that the suggestion of Mr. Lewis Hind of a war memorial has received the qualified support of our contemporary the *Builder*, which remarks that the suggestion to remove Charing Cross to the southern side of the river and to make a great monumental footbridge to commemorate the present war is a proposal which calls for full and impartial consideration after the war. The possi-

bilities of such a scheme are set forth in a sketch in the *Builder* by Mr. D. Barclay Niven, F.R.I.B.A., and Mr. T. Raffles Davison, Hon. A.R.I.B.A. This shows a vehicular bridge that would supplant the present unsightly structure, a commanding "Place," or square, on which streets converge, a flanking boulevard with gradients to the Victoria-embankment—to which Hungerford Bridge is a positive blemish—and a war memorial chapel, suggested by Mr. Lewis Hind, in the centre of the "Place." Incidentally, we may express a hope that the removal of the terminus to the south side of the Thames will also cast upon the railway company the responsibility for providing some worthier structure than the motley congeries of buildings which represent the Waterloo Station. These are, however, questions whose consideration may well be left till the after-war period. At present it is a satisfaction to know that Parliament has declined to set the seal of permanence upon Hungerford Bridge and the unæsthetic agglomeration of brick and mortar at Charing Cross.

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The Orphan Fund.

The annual report of the committee entrusted with the management of the Orphan Fund of the Institution of Municipal and County Engineers is always an interesting document, although in one aspect it is usually of a disappointing character. We refer, of course, to the comparatively small proportion of the total number of members who make any subscription to the fund. The year dealt with by the report which has just been issued is the seventeenth year of the fund's existence, but out of a total of 1,797 members of the institution it contains the names of only 217 subscribers and a list of twenty-five donations. It is true that the amount of subscriptions shows a small increase upon the sum collected during the preceding year, and this in spite of the many additional claims which have to be met at present in connection with war charities. This is satisfactory so far as it goes, but we feel bound to point out again, as we have done with regularity for some years past, that the value of such a fund is not measured by the number of large subscriptions received, nor even by the number of cases in which relief is granted. It should rather be regarded as a means by which every member of the institution may contribute his share, however small, towards the relief of the dependents of those of his professional brethren who have fallen by the way. We feel sure that those who are immediately responsible for carrying on this important and beneficent work would be immensely cheered by a large increase in the number of small subscriptions. It may be that some organisation could be started for effecting this object through the several districts. At any rate, the matter is worth consideration, and if it were ventilated it would at least serve to keep the claims of the fund before the members and to secure that its work will not be forgotten until the time comes for the next annual meeting.

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Disappointed Authors at Blackpool.

The three papers on town planning which were presented at the annual meeting of the Institution of Municipal and County Engineers at Blackpool last week proved of such interest to the members that the whole of the Thursday afternoon was taken to discuss them. This unfortunately led to the crowding out of several very interesting and valuable papers which, had time permitted, would no doubt have evoked an equally useful discussion. Unhappily, the process of elimination was repeated at the closing sitting on the following morning, when, out of a further six papers, only two, dealing with road matters, came under discussion. Among the seven which were thus left undiscussed were papers on such important questions as security of tenure, road signs, sanitation problems in civil areas in the vicinity of temporary military camps, public abattoirs, and diagrammatic statistics for municipal engineers, and when it is remembered that probably in every instance these contributions were prepared in face of serious difficulties created by reduced staffs it is not surprising that there is a feeling of resentment among the authors that the time and labour spent on their tasks should, apparently, be so little appreciated. For several years now the number of papers has been growing, and it is clearly time that the council of the institution took steps either to limit the number to be discussed or provide more time for their adequate discussion. To say the least, it is distinctly annoying for a man to prepare a paper for discussion and then find that there is no opportunity of discussing it.

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L.C.C. Housing.

Although the fact that in the past some housing schemes have been carried out without involving any charge on the rates does not show that this desirable result can be produced with labour and materials at their present prices, it is always instructive to examine the financial results of a successful undertaking. The London County Council of course occupies a unique position as a housing authority owing to the magnitude of the operations which it has undertaken. But, even when this is taken into consideration, it will be generally agreed that Sir John Benn was fully justified at the last meeting in congratulating the council upon the present position. A surplus of £26,577, to be devoted to relief of rates, is anticipated as a result of the past year's working. The nett surplus on all dwellings and estates in course of development was £11,610, as compared with £14,393 in the previous year and £15,877 in the year before that; but the extra cost of lighting, heating, insurances, taxation, war bonuses, and allowances to officers and employees serving with the Forces account for the decrease. The total capital expenditure of the council on its working-class dwellings and estates amounted, at March 31st of this year, to £3,080,814. Sir John Benn, in dealing with the report, pointed out that what is most satisfactory is that, in addition to providing necessary and healthful accommodation for the working classes, the council have been able to secure a substantial and reasonable dividend; and, further than that, this magnificent property is gradually becoming the property of London.

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A Tactless Proceeding.

We quote elsewhere *verbatim* the excellent editorial which appeared in the *Surrey Comet* of Saturday last under the heading "A Tactless Proceeding." We have omitted the name of the councillor concerned, as he, as a personality, doesn't matter. He is a type, and unfortunately there are hundreds of him scattered about among our local authorities. They are the pin-prickers—the little insignificant stinging insects of municipal life. Out of a molehill they are quick to make a mountain; their perverted instinct tempts them even to rear their mountain without even a molehill for its basis. Fortunately in this case Mr. Hampton Clucas is immune against such retailers of tittle-tattle, safeguarded as he is by the confidence and esteem won by his conspicuously able and loyal service as an official. But it often happens that a surveyor is not so strongly fortified against such attacks by innuendo, and he may accordingly suffer mentally and materially. We cannot therefore protest too vehemently against this sort of "tactless proceeding" in public life.

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Mechanical Water Filtration Plant at Lancaster.

By ARTHUR G. BRADSHAW, F.S.I., Borough and Water Engineer.

The plant consists of No. 12 8-ft. diameter Bell's vertical pressure filters, with full apparatus for chemical treatment. The raw water dealt with is collected from a moorland gathering ground into a storage reservoir of 130,000,000 gallons capacity. The site of the plant is situated 1½ miles from and 200 ft. lower than the reservoir, the filtered water being passed on for consumption without any further period of storage. The introduction of a service reservoir to contain a day's filtered supply was not considered feasible, owing to the loss of head which would have taken place, otherwise the filters would have been erected below the reservoir embankment, and under which circumstances the plant required would have been smaller, owing to the fact that an average daily output only would have been required, instead of a maximum hourly supply as now installed. The necessity for the plant was occasioned by a serious growth of algæ in the storage reservoir, resulting in the stopping up of service pipes with a matted, stringy, fibrous substance composed chiefly of dead filaments of vegetable matter. On one occasion after repairs to a fractured main as many as forty service pipes were blocked at one time.

The storage reservoir, owing to its somewhat large surface area (22 acres) in comparison with its storage capacity (130,000,000 gallons), lends itself in hot weather to the growth of algæ and minute forms of water life. A certain amount of peat discoloration had also to be dealt with. Examinations of the raw water for bacteria showed variations between the best and worst results which were not entirely negligible, more especially after a dry period, followed by a flushing of the catchment area in times of heavy rain. The period of sedimentation to which the water is subject while in storage renders the duty of the plant somewhat easy in comparison to many waters dealt with by mechanical filters.

The plant was set to work early in 1913, and has been in continuous operation since that time. The results obtained have been satisfactory, the filtered water showing a high degree of purity both chemical and bacteriological, and in some instances a sterile water has been obtained, the trouble with service pipes having been entirely eliminated. The plant from the mechanical point of view has worked successfully, and beyond the renewal of the water turbine worm and gear wheels which operate the connecting rods of the alumina injection pumps, has required little or no alterations or repairs.

The standard solution of aluminoferric is injected into the main by small ram pumps operated by water turbines, which are driven and governed by the flow of water used in the ordinary course of consumption. As the point of injection is situated below the turbine wheels, the solution is effectively scattered and mixed with the raw water before it passes to the filters, to be deposited on to the sand beds, and there in combination with lime water forms a flocculent gelatinous matter (alumina hydrate), or coagulant, in which the various insoluble impurities are entangled. No direct method of measuring the alumina solution is in operation. The solution is standardised by dissolving a known weight of aluminoferric in a given quantity of water. From this and the total recorded amount of water passed in twenty-four hours the grains used per gallon can be fairly accurately calculated.

The number of strokes made by the injection pumps being governed by the speed of the motors, which in turn is governed by the rate of the raw-water flow in the main, the amount of solution injected is proportionate to the flow. Facilities are also provided for varying the length of the stroke of the injection pumps when in motion, thus giving a finer adjustment of the amount of solution used, and which is necessary when a raw water of varying quality or colour is dealt with.

Lime water is stored in a large vertical tank, and maintained at the required strength. The extremities of this tank are connected to the throat and upstream end of a Venturi tube on the main, and by which under the Venturi law of pressures the raw water is enabled to take up lime water proportionate to its flow. The lime flow may be varied by operating a valve on the pipe connected to the throat of the Venturi tube. The actual quantity of lime passing into the raw water can be calculated at any time by reference to a manometer, and the rate of raw water flow as recorded by a Venturi meter. The manometer can also be coupled up to the meter pressure pipes, and with the aid of a graduated scale its accuracy can be tested. The method of washing out the filters is too well known to be described in detail. A manipulation of valves enables a reverse flow of water to put the sand bed into suspension, revolving arms radiating from a central column cause the sand in one operation to be raked, disintegrated, and violently sprayed.

In the case of a single filter a reverse flow at the rate of 16,000 gallons per hour has been found sufficient to disturb the bed without losing sand. A recorder is provided for ascertaining the amount of wash water wasted. This is operated by passing it over a V notch and by the usual method of a float, a clock with electric movement, and a diagram the amount can be computed. A bell arrangement warns the attendant when the flow of wash water exceeds the prearranged amount. The wash arms are rotated by a 2½-b.h.p. Tangye oil engine, each filter being engaged separately by means of a clutch, or, if required, two filters can be washed in one operation. The time occupied in washing the twelve filters varies according to the dirtiness of the beds; if done daily an average of about forty minutes is necessary. The beds are washed out as frequently as loss of pressure demands. Gauges show the total loss on the plant and also the loss due to the congestion of the beds. This loss varies according to the quality of the raw water; in our case it may be taken as 3 to 6 lb. after twenty-four hours, 10 after forty-eight hours, and 15 after seventy-two hours.

As a flow of 25,000 gallons per hour is necessary to keep the turbines working, it was thought advisable to install an arrangement whereby alumina could be added to the raw water on the Venturi principle described in the case of lime water. Governors driven by the turbine shafts were made to operate a tap controlling a subsidiary alumina solution supply. Whenever the turbines slowed down sufficiently for the balls to loose their spread the tap was automatically opened and *vice versa*. Night consumption has since increased sufficiently to render this arrangement unnecessary.

As a result of the working of the plant I am of opinion that the alumina tanks should be constructed of concrete or of iron, lined with bricks. A third tank would be an advantage. The lime chamber should be in duplicate. All pipes conveying chemicals should be copper, controlled by screw-down valves of the best quality obtainable. Jet nozzles, perforated strainer tops or boxes, and any small collecting pipes in the base of the filters should not be liable to corrosion. Test bowls continuously supplied with raw and filtered water should be in a light and prominent position, so that the attendant always has them in view. The filter-house should be heated, and one Venturi meter is essential.

In practice it has been found that with a good raw water the filters, if washed out daily, are each capable of dealing with an average of about 5,500 gallons per hour without any serious loss of pressure.

The average daily amount of water dealt with is 1,000,000 gallons. The filter and appliances have been disposed so as to avoid pipes crossing the walls and in which there is no special advantage save from a neatness of appearance point of view. From the figures given below it will be noted that the cost of housing the installation was somewhat small in comparison to the cost of the plant. It has been observed in some plants which have been visited that there is a tendency to spend money rather lavishly on the housing, so much so that in odd cases the house has cost almost as much as the plant. Much of this expenditure appears to be unnecessary for proper and efficient working, and can hardly be claimed as having any material effect on the results to be obtained.

Analyses of samples of the raw and filtered water should be frequently made, and in this respect it will be of great assistance when analysts are able to submit the results of their investigations in some recognised standard form. Additional competition in the

sale of suitable alum meterie is also desirable. Frequent tests for alkalinity or acidity should be made, either with lacmoid or phenol phthalein.

Generally, the opinions which have been expressed to me to time regarding the defects of mechanical filters, as compared with open sand filters, have not been found to exist in the working of the plant. Re-wash pipes were installed for the purpose of running a certain amount of water to waste immediately after washing out, in order to allow the beds a little time to coagulate. This operation may be required where a bad raw water is dealt with, but it has not been found necessary in this case. A bright, clear water, capable of undergoing close examination, has been obtained at all times. A careful and intelligent man is necessary to look after the plant, and the records of its working should be systematically kept and scrutinised.

Average amount of aluminoferric used, half a grain per gallon.

Average amount of lime used, one-tenth of a grain per gallon.

Total cost of running the plant for year ending March 31, 1916, apart from interest and redemption of capital, £150, or 8s. 2d. per million gallons treated.

Amount of water lost in washing out, three-quarters of 1 per cent.

Cost of the plant, £4,000, and land, buildings, meter, &c., £1,500.

Wages of attendant, 36s. per week.

Price of aluminoferric, 1913, £3 2s. 6d. per ton.

Price of aluminoferric, 1916, £5 7s. 6d. per ton.

Hardness of raw water, 2 deg. (Clarke's scale).

CIVIC STUDY IN CIVIC DESIGN.*

By PATRICK ABERCROMBIE, M.A., A.R.I.B.A.,
University of Liverpool.

Into town planning as a general subject it cannot be said that this country plunged without very considerable preparation. Ten years before our Act was passed organised visits had been paid to the Continent, where the practice of civic design had not been suffocated by the industrial revolution, as with us, and before anyone got to work on actual schemes several general treatises had been published, and at least one notable Continental report issued by a municipality.

But it is in the conduct of individual town planning schemes under the Act that some tinge of our national habit of unpreparedness appears; the very nature of the Act itself, which proceeds by means of individual schemes, isolated by red lines, appears to encourage a piecemeal treatment of the subject, and the intricacies of a new piece of legislation naturally tend to a preoccupation with the statutory stages of its procedure. At none of these stages is there any necessity to discover what preparation of general considerations have preceded the particular scheme, except in so far as it is obligatory to show that the land is likely to be developed in the near future. That such preliminary thought is given in many cases is undoubted; but it may not be amiss to attempt to methodise the natural progression of study under which town planning must proceed, if full justice is to be done to the complexity of the problem and that degree of comprehensiveness attained which is the distinctive difference between town planning of the present day and in the past. There is no claim that the method to be set forth is an original or novel suggestion: it has certainly been adopted by many of those who have produced schemes under the Act; but few will deny that it has been applied unconsciously rather than as an ordered method of progress.

The three stages, then, to be considered are: (1) The civic survey, (2) the comprehensive town plan, (3) town planning schemes for definite areas. It is easy to think of a case where this threefold progression has been adopted unconsciously with satisfactory results; a small isolated country town, whose growth has been somewhat quickened of recent years, decides to make use of the Town Planning Act for the third stage—a scheme for a definite area. The matter is in the hands of the borough surveyor, who, knowing his own town as every borough surveyor, of course, does, sees no need for the production of a formal civic survey or general town plan, for the simple reason that both these exist at the back of his head, his town is of a size easily graspable without graphic representation—he knows which roads are adequate for the traffic and which are not—how much overcrowding there is—the relation between his proposed improvements and land values—and, as to open spaces, he is aware that the country is within a few minutes' walk of everyone.

INDUSTRIAL DEVELOPMENT.

But our old-fashioned market town may be in a more definitely transitional stage, threatened with an industrial development which it does not wish to avert but at the same time was quite happy without. Suppose it to be at the same time an ancient cathedral city, owing a large part of its prosperity to its attractiveness to visitors; its four main cross-roads lined with old buildings, an asset of permanent value; trams have been laid on the cross-roads, but all thought of widening is out of the question. Another cause of the city's prosperity is a river much used for pleasure parties. Upon this peaceful, prosperous community, battening on Americans and visitors from distant industrial centres, has descended a sudden industrial incursion. Part of this is encamped just outside its municipal boundary, near a convenient waterway; a squalid jerry-built township is springing up in juxtaposition to one of its best residential suburbs; added to this, a large industrial population, working some miles away, prefers to congest the cheerful city's slums rather than to live in the dull country. Here, then, is a case for serious study of existing conditions and a prophetic town plan; it behoves that city to take deep thought for its whole future; it is by no means sufficient to go in for a simple town planning scheme on one side of a protective nature. What is to be done in view of a possible doubled population, and the central streets, not to be subjected to the usual panacea of widening, already congested?

PAROCHIAL TOWN PLANNING.

If the complexity of the problem of this single town suggests the need for general study and planning before separate schemes are initiated, how much the more is this essential in those districts where many towns are found closely associated by community of interests and natural regional conformation? Here it is impossible, or rather municipally immoral, for one town to plan for itself without consulting with its neighbours. South Lancashire, South Yorkshire and the Birmingham district are three such urban agglomerations in which parochial town planning would prove a fatal blunder.

It is not necessary on this occasion to schedule the headings under which a civic survey should be grouped; everyone who has prepared one, whether formally or informally, knows what data are necessary upon which to build town planning, and to what extent the emphasis on different phases varies in each case—for example, the historic aspect sometimes is of first importance, at others practically negligible. But it is worth while pointing out that a civic survey when formally compiled has another use apart from that to which the technician will put it; to the general public a graphic statement of existing conditions will come in many cases as a revelation, and in town planning the backing of public opinion, as epitomised in the eagerness of the Town Planning Committee of the corporation, is of the utmost value. This latter use will amply justify the production of a civic survey for single towns, however familiar its details may be to the official mind.

THE GENERAL PLAN.

For separate municipalities the whole range of town planning activities can be dealt with in the form of general proposals. The great advantage of this general plan stage is that it gives the opportunity for a spark of imagination to lighten up our painstaking, humdrum work. This is much more likely to occur at this stage than while we are engaged in drafting watertight clauses for a scheme, and producing plans designed to give away our intentions as little as possible. And for this reason it is sometimes desirable that this general plan should not be prepared—at any rate if it is to be published—wholly by officials of the city. Another advantage of the general plan stage is that it makes the planner, or the committee of planners, definitely decide upon the type of town for which they are working, so that a form of development in consonance with this type may be encouraged, and no attempt made to impose upon its exotic ideals.

To sum up, it is contended that in large urban agglomerations a civic survey of existing conditions

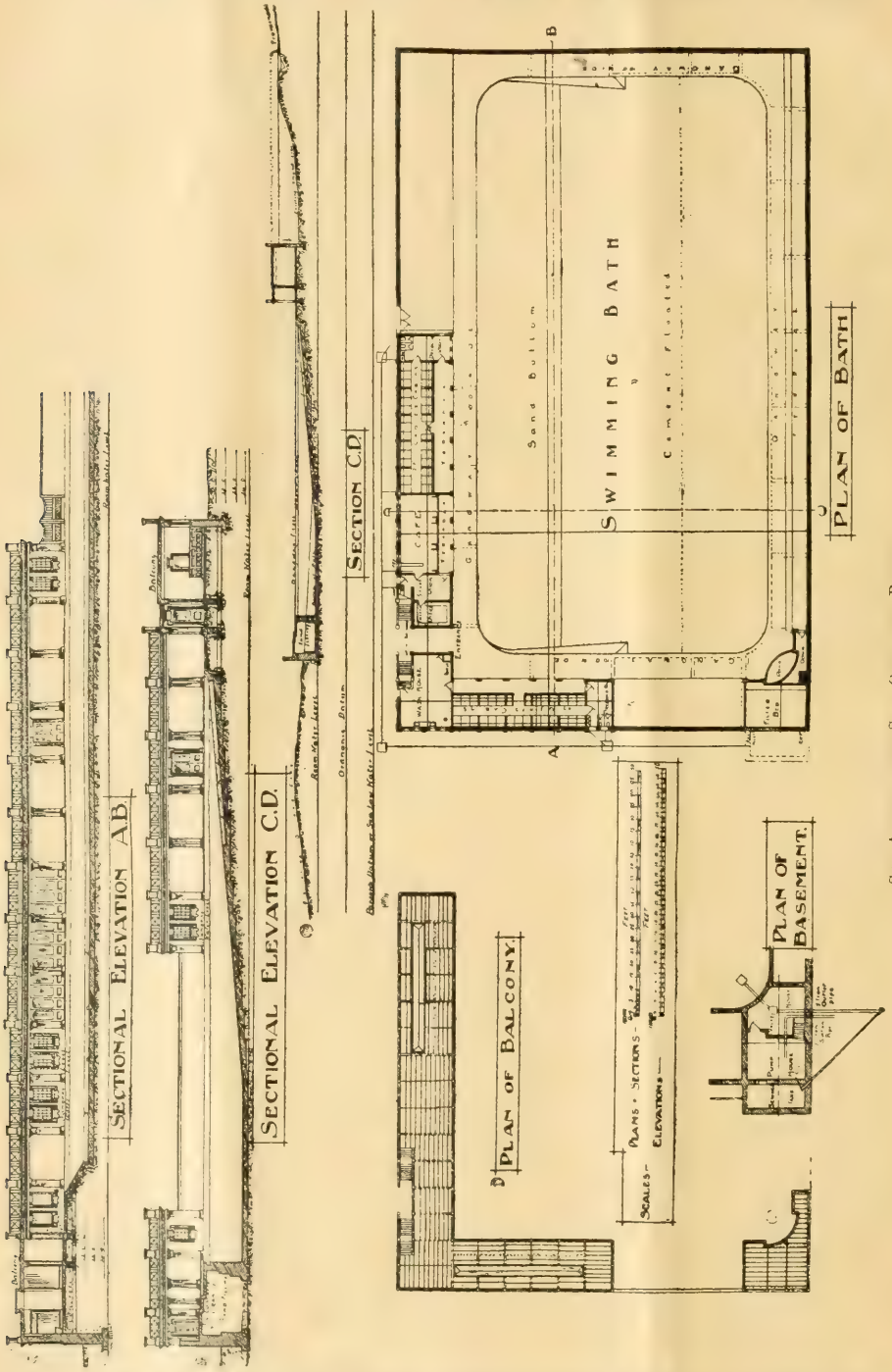
* From a paper presented at the annual meeting of the Institution of Municipal and County Engineers held at Blackpool last week.

and a general plan embodying proposals for certain aspects are essential; and the municipalities concerned should appoint joint committees to draft out the main lines of such a plan, following the precedent of the London Traffic Sectional Conferences; secondly, that a definite adoption of these two stages as the necessary preliminary to town planning schemes under the Act is extremely desirable even for the isolated urban community. Furthermore, the value of publicity at these two earlier stages outweighs its drawbacks.

ST. ANNES-ON-THE-SEA OPEN-AIR BATHS.*

By J. S. Sawdon, Assoc.M.Inst.C.E.,
Engineer and Surveyor to the Urban District Council.

In October, 1913, the council decided to advertise for designs in open competition for laying out the foreshore, including open-air sea-water baths. The first premium was awarded to Mr. Fred Harrison.



St. Annes-on-the-Sea Open-air Baths.

* From a paper presented at the annual meeting of the Institution of Municipal and County Engineers held at Blackpool last week.

M. S. A., architect, St. Annes-on-the-Sea and Accrington, who has designed the baths and supervised their construction, and to whom the author is indebted for many of the following particulars.

The bath is 240 ft. long, 120 ft. wide, and holds 819,000 gallons, weighing 3,750 tons. For a width of 36 ft. the bath is 7 ft. deep, and the remaining 84 ft. are formed with a sloping bottom to a gradient of 1 in 12. Eleven teak ladders are fixed vertically against the walls, and at the ends of the deep portion, and a moulded terra-cotta scum-channel is fixed along the deep side and ends of the bath just above the surface of the water, which also serves as a hand-rail. The scum-channel is connected to the outlet pipe from the bath, and acts as an overflow, so that during the time that the pure filtered sea water is being pumped in at the bottom of the bath the surface water overflows into the scum-channel and thence into the sea. A diving stage is erected on the north gangway with two springboards, one being 8 ft. 6 in. high and the other 15 ft. high. A water-chute is also provided. The buildings have been designed in a simple Renaissance style. The walls are constructed of brick, rendered with Portland cement.

The filtration plant for purifying the sea water before it passes into the bath consists of a concrete filter-tank, 25 ft. long by 17 ft. wide, with a 10-in. distributing pipe on top fitted with five cones for regulating the delivery. At the bottom of the tank is a 10-in. distributing pipe, tapped with forty-eight 1½-in. tapped bosses for carrying the filter tubes, and connected to forty-eight 2-in. copper tubes, perforated with fine holes, and each fitted with gun-metal connector. Brass-lined wedge valves, 10 in. and 6 in., are provided to control the working of the filter.

The filtering material covering the perforated tubes comprises 12½ tons of coarse gravel on the bottom and 23 tons of Norwegian spar.

The water is raised to the filter by means of an electrically driven "Sunturbo" self regulating pump, capable of delivering 30,000 gallons of sea water per hour when running at a speed of 800 revolutions per minute. The pump is directly connected through a flexible coupling to a 10-h.p. shunt-wound motor at 480 volts. The pump and motor are mounted on a massive cast-iron bed plate, and are fitted with a starting panel D.P. switch and fuses.

The water is drawn through an 8-in. iron suction pipe 650 ft. long, and allows about two hours' pumping before high-water and about two hours' pumping after high-water, and is fitted with an 8-in. foot valve. The bath bottom at the deep end is fitted with a cast-iron run-off box 24 in. by 24 in., with heavy brass grid, and controlled by a 12-in. brass-lined wedge valve and connected to 12-in. diameter steel tubes 700 ft. long for emptying the bath.

In order to prevent the discharge of dirty water while the fresh water is being pumped, an electrical appliance is fixed to the run-off valve, which automatically cuts off the current from the pumps when the valve is open.

The promenade and gangways are laid with reinforced granite-faced concrete, and the roofs of the buildings are of solid concrete and iron covered with natural rock asphalt. The dressing accommodation comprises twenty-seven ladies' cabins, with dressing-rooms, fitted with dressing-tables, mirrors and lavatories. A hot-water service is provided to enable each bather to have a hot foot-bath after bathing. Cold shower-sprays are also provided. The accommodation for gentlemen is precisely the same as that for ladies. A café, 33 ft. by 16 ft., is erected with verandah, having folding screens, which can be thrown open if required. A wash-house 31 ft. by 15 ft. is provided with drying closets and electrically driven machines and wash-tubs. Provision has been made for spectators by means of raised terraced seats.

An electrically driven 3-in. centrifugal pump is installed for purposes of pumping sea water from the bath and discharging same into water-carts. It is the intention of the council to use salt water for watering the roads.

With regard to the disposal of sewage, an underground tank is provided, fitted with an automatic electrically driven pump.

Waterproofing of Cement.—St. Mark's Vicarage, at Oldham, which is of stone construction, has been repointed with cement to prevent penetration of considerable dampness. The work has been pronounced as thoroughly successful. The architects utilised the powder "Pudlo" with the Portland cement as a waterproofing medium.

CORRESPONDENCE.

Εις ἀνήρ οὐ πάνθ' ὁρᾶ
(One man does not see everything.)
—Euripides.

TRANSPORT REFORM.

To the Editor of The Surveyor.

Sir,—I have read Mr. Wood's letter in reply to Mr. Mansfield. As Mr. Mansfield is far away from London and Mr. Wood is in London, it would surely be the best course for Mr. Wood to pay a visit to the British Museum Library and examine the maps there. He would then be in possession of the facts. Mr. Mansfield has stated that there are seventy-four goods stations in London which are not coal yards; he is probably quoting from the list given by me in my lecture at the Royal Society of Arts—a document which may be quite unconvincing to Mr. Wood, but which, as at present advised, I do not see my way to amend.

If Mr. Wood will refer to the Railway Clearing House Official Handbook of Railway Stations, &c., of the United Kingdom, published by the Railway Clearing House, Euston-square, N.W., he will then satisfy himself as to prevalence of opinion as to the existence of these seventy-four goods stations. He will also discover that there are fifty passenger stations in addition to the seventy-four which are used for goods. He will see many other useful items of information to a writer on the subject.

If Mr. Wood had accepted my invitation to the works at Battersea he would have been able to inspect the ground plans of every goods station and coal yard in London. I now renew that invitation in all friendliness.

I have been privileged to read an advance copy of Mr. Roy Horniman's forthcoming book, "How to Make the Railways Pay for the War," and all Mr. Wood's questions and many others are answered therein.—Yours, &c.,

A. W. Gattie.

11 Montague-gardens,
Birch-grove,
Acton, W.
July 3, 1916.

WHAT IS BITUMEN?

To the Editor of The Surveyor.

Sir,—The Engineering Standards Committee's report upon the classification of asphalts, bitumens and pitches "for road purposes" does not appear to have been very enthusiastically received, and I am tempted to ask if engineers are likely to adopt its recommendations, or will they continue to form their own opinion of what is bitumen and what is not?

The long-standing threat or promise to give petroleum-pitch the better sounding title of bitumen is now apparently an accomplished fact. One can, of course, obtain a considerably higher margin of profit by selling petroleum-pitch as bitumen, but why should this advantage be confined to one kind of pitch only? Coal-tar pitch, for instance, is the equal of petroleum-pitch in every way except the smell, and it is not, surely, seriously contended that the smell alone stands in the way of it being called bitumen?

No reply has ever been given to the question why all residues or pitches should not be known as bitumen if petroleum-pitch is to be so described.

The committee appear to have given particular consideration to American practice, although the home of the asphalt trade is on the Continent, and nowhere are the terms bitumen, asphalt, asphaltum, &c., more loosely handled than in America, where the committee look for guidance.

It is, however, in the hands of the engineers themselves to decide whether they follow the American method of calling petroleum-pitch bitumen, or take their stand with Continental and English authorities, who tell us that bitumen is a product of Nature.

I am of the opinion that it is possible to prove to the satisfaction of the legal authorities that the last-named material is what has all along been generally recognised in this country as bitumen, and as this practice will to my knowledge be continued by many, the proposed new title therefore to an old-established trade material can only lead to a considerable amount of confusion.—Yours, &c.,

A. E. H. Dusser.

Bromley-by-Bow,
London, E.
July 3, 1916.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING AT BLACKPOOL.—(2.)

The telegraphic account of the annual meeting of the Institution of Municipal and County Engineers at Blackpool which appeared in our issue of Friday last covered the proceedings at that gathering down to the adjournment for luncheon on the opening day. The discussion of papers commenced in the afternoon, but at the close of the sitting only three of the six contributions which it had been arranged to take had been disposed of. At the second and concluding sitting on the following morning a further six papers were to have been discussed, but again time did not permit of the agenda being adhered to, only the first two papers on the list being dealt with. Thus, of the twelve which had been prepared, seven—to the keen disappointment of the authors—remained undiscussed. Thursday's sitting was occupied wholly with town planning questions, the three papers presented being by Professor Abercrombie, F.R.I.B.A., Messrs. H. Shawcross and H. R. Aldridge, and W. Ross Young. Some extracts from these contributions will be found elsewhere in this issue. The following is a list of those present at the meeting:—Members: Messrs. J. S. Brodie (president) in the chair, J. E. Aldersley (Earby), S. C. Baggott (Macclesfield), L. L. Baldwin (Coalville), W. E. Beacham (Leek), P. A. Benn (Lichfield), R. H. Bicknell (Westminster), J. Birch (East Ham), H. Bottomley (Bingley), H. L. Bottomley (Hebden Bridge), J. Bowen (Reading), O. A. Bridges (Bognor), J. A. Brodie (Liverpool), C. Brownridge (Birkenhead), J. Bryce (Glasgow), J. A. Budge (Birmingham), T. Bull (Thurnscoe), S. E. Burgess (Middlesbrough), T. Burrows (Lathom and Burscough), R. Burslam (Congleton), A. Burton (Stoke-on-Trent), A. H. Campbell (Edinburgh), W. Louis Carr (Ruislip-Northwood), H. T. Chapman (Kent County Council), F. T. Clayton (Reigate), W. A. Clegg (Dorking), T. P. Collinge (Rotherham), A. E. Collins (Norwich), J. Cook (Fylde Water Board), J. B. Cooke (Denton), C. H. Cooper (Wimbledon), A. E. Coupe (Fulwood), S. H. Davies (Wirral), N. F. Dennis (West Hartlepool), P. Dodd (Wandsworth), D. A. Donald (Grangemouth), J. H. Drew (Wath-on-Dearne), D. Edwards (Taunton), W. H. Elce (Bacup), J. Price Evans (Wrexham), W. Finch (Cumberland), W. Fowlds (Keighley), J. K. Frazer (Airdrie), J. Gammage (Dudley), C. F. Gettings (Worcester County Council), S. Gibson (Biddulph), G. Gledhill (Adwick-le-Street), H. Goodfellow (Southport), W. J. Goodwin (Salisbury), A. T. Gooseman (Wigan), A. H. Goudie (Stirling), A. D. Greatorex (West Bromwich), G. Green (Wolverhampton), W. H. Grieves (Sutton), H. F. Gullan (Belfast), W. J. Hadfield (Sheffield), C. W. Hall (Felling-on-Tyne), W. Harpur (Cardiff), Frank Harris (Tonbridge), T. Harrop (Bispham with Norbreck), G. A. Hart (Leeds), G. B. Hartfree (Alton), J. E. Hattersley (Buckingham), T. W. A. Hayward (Battersea), S. S. Haywood (Brighouse), J. A. Heap (Todmorden), J. R. Heath (Swansea), S. J. Hellier (Finchley), O. Helliwell (Manchester), T. Henry (Retford), J. R. Hill (Ipswich), C. E. Hines (Windermere), H. Holmes (Ossett), J. Johnson (Rawtenstall), E. W. Jones (Wrexham), R. R. Jones (Milnrow), W. Matthews Jones (Chester), W. Jones (Colwyn Bay), J. D. Kennedy (Retford), L. Kenyon (Tottington), A. M. Ker (Warrington), G. W. Lacey (Oswestry), G. W. Lawson (St. Annes-on-the-Sea), J. Lobley (Stoke-on-Trent), R. A. MacBrair (Lincoln), L. S. McKenzie (Bristol), F. Mansfield (Abergavenny), L. P. Marshall (Rangoon), E. B. Martin (Salford), Frank Massie (Wakefield), T. H. Maxwell (Fylde), A. J. Metcalfe (Ashbourn), R. Millar (Greenock), G. C. Mitchell (Stockton-on-Tees), T. Moulding (Exeter), T. Nisbet (Glasgow), J. B. Nuttall (Haywood), J. Nuttall (Woodlesford), P. H. Palmer (Hastings), J. Parker (Hereford), James Paton (Plymouth), W. C. Persey (Barrow-in-Furness), F. R. Phipps (Basingstoke), J. S. Pickering (Cheltenham), T. S. Picton (Eccles), W. Plant (Stafford), S. S. Platt (Rochdale), A. E. Prescott (Eastbourne), A. J. Price (Lytham), W. H. Price (Birmingham), J. J. Quirk (Brynmawr), A. Race (Blackburn), W. Ransom (Worcester), C. E. Rivers (Harrogate), O. C. Robson (Willesden), L. Roseveare (South Shields), A. Rothera (Spenborough), T. Salkield (Delhi), W. H. Schofield (Lancashire County Council), Norman Scorgie (Hackney), W. Shackleton (Nelson), H. Shaw (Ilford), E. J. Silcock (Westminster and Leeds), J. S. Sinclair (Widnes), J. F. Smillie (Tynemouth), C. Chambers Smith (London), J. D. Smith (Kirkcudbright County Council), P. C. Smith (Dunfermline), J. Southwart (Rothwell), N. F. Spence (Marlborough), J. P. Spencer (Tynemouth), F. W. Spurr (York), A. P. Statham (Salford), A. Stevenson (Ayr County Council), H. E. Stilgoe (Birmingham), W. Stubbs (Blackpool), J. Sutcliffe (Woolwich), J. E. Swindlehurst (Coventry), T. Thomson (Dundee), J. A. Tonge (Rawmarsh), W. H. Travers (Wallasey), H. Tremelling (Newport), J. P. Wakeford (Wakefield), H. T. Wakelam (Middlesex), A. H. Walker (Loughborough), J. H. Walters (Congleton), A. W. Ward (Shrewsbury), W. Watson (St. Andrews), J. A. Webb (Hendon), J. Scott Weir (Jarrow-on-Tyne), H. G. Whyatt (Grimsby), G. H. Wild (Littleborough), J. W. Wiles (Manchester), F. Wilkinson (Deptford), F. Wilkinson (Prestatyn), M. H. Wilkinson (Leyland), E. Willis (Chiswick), O. E. Winter (Hampstead), R. H. Winterbottom (Irlam), F. J. Wood (East Sussex County Council), P. C. Woodhall (Uttoxeter), F. C. Woodward (Stourbridge), E. Worrall (Stretford), G. E. Wrigley (Banbury), F. Spencer Yates (Waterloo), J. Young (Ayr), W. Ross Young (Lanark County Council, Middle Ward); Visitors: Messrs. P. Abercrombie (Liverpool University), H. R. Aldridge (National Housing and Town Planning Council), O. R. Anstead (East Ham), T. Arnall (Birmingham), F. Bailey (Brynmawr), Alderman R. Bainbridge (Stockton-on-Tees), J. Berry (Kingstown), W. S. Body (Birmingham), J. Broughton (Hightown), W. W. Chapman (Airdrie), G. Davies (Widnes), W. H. S. Dawson (Bradford), Alderman J. C. Dexter (Birmingham), D. Dickinson (Blackpool), J. Eastwood (Sowerby Bridge), E. T. Everton (Birmingham), D. Graham (Glasgow), T. Greenwood (Todmorden), F. H. Grinsham (Atherton), J. D. Harward (Worcester County Council), J. H. Helliwell (Mytholmroyd), H. Hind (Erith), H. Hirst (Spenborough), J. Howard (Worsley), E. W. Rees Jones (Blackpool), H. J. Kilford (Ilkeston), O. J. Kirby (Batley), W. Lawrence (Stockton-on-Tees), E. R. Lightwood (Lytham), S. C. Lloyd (Dudley), S. Lloyd (Bristol), D. Marlor (Heywood), J. F. Meese (Smethwick), T. Merrells (Swansea), W. Muirhead (Liverpool), D. Mullins (Rotherham), W. Nicol (Glasgow), W. F. Pinfold (Prestwich), Marlow Reed (Middlesex County Council), W. A. Riley (Birmingham), W. Roberts (Cardiff), G. M. Robinson (Greenock), A. Spence (Dundee), E. Squire (Belfast), S. Sutcliffe (Mytholmroyd), A. Sutton (Bradford), G. Symon (Blaydon-on-Tyne), H. Thompson (Basingstoke), T. Thompson (Eccles), J. Thornton (Retford), T. Tidswell (Sowerby Bridge), Alderman Timmion (Warrington), H. Trafford (Burscough), H. Walker (Hereford), C. Warren (Exeter), F. P. Williams (Prestatyn), Councillor J. E. Williams (Birmingham), Alderman G. F. Wilson (Ossett).

The first paper to be discussed was that of Prof. Abercrombie, F.R.I.B.A., on

CIVIC STUDY IN CIVIC DESIGN.

Mr. J. A. Brodie (Liverpool) said he thought the institution was to be congratulated upon having a paper which put before the members points which they should very carefully think about. Professor Abercrombie said, and quite truly, that a number of things which he was recommending had been done in a way, and those who had studied this question for a time knew that those things should be done one way or the other. They might differ as to how things should be done. They might think that the people who had been working on these things knew a good deal about the subject, but the matter was so important that every information should be available before dealing with the question of planning. His own view was that they might easily go too fast in connection with town planning. He thought there was quite as much danger from hastily putting forward plans in connection with town planning as from delaying them. He was glad to say they had been dealing with traffic and main lines of communication. The earliest stages, and the most important were those which dealt with main lines of communication, and what

might taught well the skeleton plan of the whole scheme. So far as South Lancashire was concerned, he was not sure that they had done all they ought to have done as regarded the effect that town planning in one authority might have upon the adjoining areas, and he believed the advice given, and the method of dealing with the whole of South Lancashire, if followed and taken up heartily by the surveyors of the different authorities, would do a very great deal of good.

Mr. H. E. Stilgoe (Birmingham) said that in his city they had already completed two schemes which were now Acts of Parliament. They had in hand three schemes which embraced over 20,000 acres, and they commenced their scheme by planning the whole area of 43,000 acres beside the area outside the city. One of their first works was to make their scheme for the great arterial roads, and they also prepared plans to show how those roads should be widened and what other arterial roads and secondary roads should be provided.

Mr. W. H. Matthew Jones (Chester) said he must congratulate Prof. Abercrombie upon this paper, which was extremely interesting. He had not read very far before he found a reference to an old-fashioned market town which was somewhere near where he came from. He was pleased to see that Prof. Abercrombie stated that the outside authorities in the rural area adjoining such a town could not deal with this problem for themselves. This town was practically built up, and it was the outside authorities that would have to deal with the town plan so far as the outside district was concerned. That was his opinion. The borough was bounded by three counties, Cheshire, Denbigh and Flintshire, and those authorities would have to consider how they were to plan for the development into their respective areas. He thought they ought to do that jointly. He held that the county council should lay down through their district the main roads they would like constructed through the district. If this was done the borough could join up the main roads from its own area to the roads which came through the county. It was no use town planning a scheme setting out roads here and there which suited only the town. They had to look beyond the town to see what the effect of the road would be as to through traffic. If they did not do that the county council could come along and knock the whole scheme on the head by refusing to link up the roads in a proper way. If a county council would prepare a scheme showing its roads it would help the borough authorities in preparing their schemes. There was another point in the paper with reference to the congested area in the centre of the town and the narrow streets. It seemed to him that it would be a wrong thing to widen some of the streets in Chester. Those streets contained half-timbered buildings, many hundreds of years old, of historic and archæological interest, and it would be a scandal to remove them. But if on the outskirts of the city the county councils would lay out some broad lines to go upon it would be better for future development. On the outskirts of the city there were none but small authorities, who could not of themselves afford to go in for any scheme of town planning, and therefore it would fall upon the city authorities to prepare a town plan for the outside districts. He did not consider it was quite fair for the borough engineer to have to prepare a scheme for an outside authority. He had quite enough work to do for his own authority, and he got nothing for his work. There should be some legislation to provide that if a borough engineer prepared a scheme for an outside authority the work should be paid for by the authority concerned.

Mr. J. F. Smillie (Tynemouth) said he had read this paper with great interest. Prof. Abercrombie was a counsellor of perfection, but in the early part of his paper he implied a certain narrowness of outlook to those who had been preparing town planning schemes. He said the Town Planning Act seemed to have encouraged a piecemeal treatment of the subject. He was not prepared to argue whether the surveyors of local authorities did take that view or not, but he said frankly that the Town Planning Act prohibited anything but a piecemeal treatment of the subject. The Act specifically stated that it applied to land in course of development, or likely to be used for building purposes. If that did not mean a limitation he did not know what the words meant. Take a case where one attempted to include for the purpose of a wider scheme a large area of land. Six or eight years ago the landowner would not have been averse to the proposal, but to-day he said, "I cannot agree to my land being included in the scheme," because he was faced with the fact that if it was potentially land considered ripe for building he was likely to have a land tax placed upon it. Their scheme covered so many areas; they might propose to include 1,500 or 2,000 acres in the area to be planned, but they could not say that it was likely to be developed for building purposes within a reasonable time. Therefore they were not able to put forward a comprehensive scheme of town planning. The flaw was in the Act of Parliament, and was not the fault of those who prepared schemes. There should have been no limit to the area, and then they would have avoided any question of potential building land in town planning schemes. They might include in schemes land which would never be built upon, but they might exclude land which might tempt the landowner to develop for building purposes. He sympathised with the ideals set forth in the paper, and he should be delighted to follow them. He had been in consultation with the officials of the Local Government Board, and he had been told that without legislation it was no use their putting forward certain areas in a scheme.

Prof. Abercrombie said the only point to reply to was as to the responsible authorities in rural districts. He had omitted that because it seemed to apply to obligatory town planning. The suggestions were in a sense idealistic. He referred to a method of procedure, and pointed out that it was not absolutely the method which the present Act gave them. He should suggest that it might be necessary to have new legislation for this comprehensive treatment.

The meeting next proceeded to the consideration of papers by Messrs. H. Shaweross and H. R. Aldridge on

OBLIGATORY TOWN PLANNING.

Mr. W. Harper (Cardiff) said he was very glad that Mr. Aldridge had said this was a tall order. If they were to discuss all the points in this paper it would take all the time of the conference. There was a good deal that was controversial, and if he did not challenge many of the points in the paper, he hoped it would not be taken for granted that he accepted them. Mr. Aldridge said, taking next the second case—viz., that of the skilled engineer entrusted with the task of establishing a new suburb with 1,000 houses—would he permit his village to grow on by-law lines? Could there be any doubt as to the answer? He would surely welcome with delight the opportunity to create a well-proportioned suburb, and would not dream of permitting the reproduction of the monotony which marks the typical by-law suburb. But when they came to carry out this kind of thing the question arose at once, "What is it going to cost?" That was what the engineer was met with. In the question of houses, he was told that houses must be built of a given size, of so many rooms, and at a cost at which they could be let at a given rent, and no charge fall upon the rates. This had to be done at the sacrifice of artistic features. When an engineer had to carry out a plan on these lines, naturally artistic features had to go by the board. Next, he would like to say a word in reference to poor old Dowlais. Mr. Aldridge had some very caustic remarks to make about the poor old town. When one went on to the Continent with his eyes and nose closed to that which was bad, and came back enthusiastic over the glories of the town planning of Continental cities, one visited the worst places, not with eyes closed to what was there, and there was no need to stop up his nose in this country as he did on the Continent. One said: "How bad! how frightful! how disgraceful!" That was the point. When they went abroad they looked for the good and closed their eyes to what was bad. Let them not only condemn what was bad, but give themselves credit for what had been done to improve things. He presumed Mr. Aldridge was at Dowlais for a few hours. He had known old Dowlais for fifty-seven years, and he had known it intimately for the whole of that time. There had been some good things come out of Dowlais. Some of the very best coal that could be produced; some of the very best steel that could be produced; and, above all, he knew one very good wife and very good mother. When he first went into Dowlais it had no water supply, and in summer-time it was a common thing to see hundreds of

people, mostly women and boys and girls, standing with their buckets at a well or a spring by the roadside. The quality of that water was never tested; they might guess what it was. Those people were accustomed to staying all night waiting their turn to get a drop of water to drink. Dowlais had no sewerage, no drainage, all the filth of the houses was thrown into the street, liquid and solid, and that was the only method they had of watering the streets. Now those things had been changed. There were other things in the old days. There were hundreds of back-to-back houses; there were many of what he called double-decked houses. One house of two storeys backed up against the hill, and for the lower storey no outlet and no outlook but on the one side. There were hundreds of houses with not a single square inch of land belonging to them, except the street in front, and not even a very wide street at that. In addition to that there were hundreds and hundreds of houses which had no water-closet or privy of any description—a very great deal had been done to alter the condition of things in Dowlais. Perfection had not been reached, and could not be reached without clearing the whole place. Every house had now one of the best supplies of water that could be found anywhere; every house was drained, and nearly every house had got its own water-closet. he believed there were a few cases where there was a water-closet for two houses. Dowlais stood at a level of from 700 ft. to 1,100 ft. above sea level. Many parts of its main street were steep, and many of its side streets had gradients of 1 in 5 or 6. Immediately they stepped out of Dowlais they were in some of the finest country in the kingdom. On the one side there was Morlais Castle, free for anyone to wander over; then they had the river Taff Fechan, extending from Pontsarn to Pontstickell, abounding with trout, where the workmen could go at night, after their day's work, and catch their morning's breakfast. Dowlais and Merthyr were the first to tackle epidemic diseases, especially small-pox. Dowlais had one of the first infectious diseases hospitals ever erected in this country, it was over fifty years since they put up that hospital. It was also one of the first places which put up an apparatus to disinfect clothing by the application of heat, although he must admit that in the early days they destroyed about as many clothes as they disinfected. Things had very much improved. Dowlais and Merthyr had one of the best methods of sewage disposal. It was a pioneer in that matter. It was forty-two years ago since he made a civic survey of Dowlais—that was to say, he made a house-to-house survey of Dowlais after an epidemic of small-pox, and he ascertained every house in which there had been an epidemic, and marked on a map every house in which disease had occurred. That was done with a view of ascertaining the cause and the remedies, and the result had been that Dowlais—black as it was—had no more cases of small-pox than other towns. He thought as Dowlais had been painted so black he would like to say a few words about the poor old place. Mr. Aldridge asked the question, "Is it essential that planning shall be made obligatory in rural districts?" He said Yes, because it was in rural districts that the foundation of urban districts was neglected; and if the foundation was neglected, it followed that the structure must be bad. Unfortunately, he knew many places where this had happened. He thought South Wales was very typical of the absolute neglect of rural districts in the first starting of those districts into urban areas, and the neglect had been something fearful, with the result that places were absolutely thrown together, at any kind of level, one house in and another house out, and so forth. Even the main roads had been ruined by the acts of rural councillors, by their neglect to provide for future development. If there had been any foresight they might have arranged for something very different to be done. For that reason he thought it was very essential that planning should be made obligatory in rural districts.

Mr. E. Willis (Chiswick) said that to a large extent he was in sympathy with the principle of compulsory town planning, but he did not think the time had yet come for it. At the same time, it was necessary to have pioneers, and to have these gentlemen with driving force. Mr. Aldridge had said there were engineers with that driving force; a very good example of it was to be found in Mr. Aldridge. If Mr. Aldridge would gather together the members of their county, borough, district and rural councils in the Albert Hall and drive it home to them, they might get nearer to attaining their object. They must be prepared to drive home the importance of town planning on every available occasion. Even Mr. Harpur had admitted the desirability of rural planning. He was quite sure that neither Mr. Harpur nor Mr. Aldridge expected them in rural areas to attempt anything like the town planning they were attempting in the cities. It was a modified scheme, a scheme which would prevent the breach of amenities which already existed in so many towns, and which they wished to avoid for the future. On the other hand, there was set forth the various points which it was suggested local authorities should include in their schemes. He did not agree as to the necessity of having compulsory town planning to attain those objects. He thought they were going to get those powers in future, but he thought many of those objects they would get in a Public Health Amending Act. The 1907 Act did them a great deal of good, but when this war was over he thought the time would come for an amending Act to consolidate the whole of the Public Health Acts which had been put on the Statute Book, and he thought many of these clauses could be put in such an Act.

Mr. H. Gilbert Whyatt (Grimsby) said they usually regarded Mr. Aldridge as visionary, but in this paper he was intensely practical. He did not see as much in the paper to dispute as did Mr. Harpur. He believed that Mr. Aldridge coming among engineers had been made more practical. They were, of course, intensely utilitarian, and they could not do very much with visions. The great difficulty they had was that mentioned on the previous paper by Mr. Brodie, of Liverpool, of the necessity of making haste slowly. Some of them, looking at the districts round their county boroughs, could not tell where the next development was going to take place, or if there was going to be any development in the next thirty years. But there was all the more need for having the schemes for their main roads laid out, and the details left for future consideration with the Local Government Board if they liked. The town planning schemes at present went too far. The scheme might be divided into two parts—first, the main roads, and then a second application to the Local Government Board for the portion of the area then required to be developed. The question was mentioned by Mr. Aldridge as to what was going to happen at the end of the war. They did not know; they could not tell. The Local Government Board might pursue their present cautious policy as to allowing money to be borrowed, even if the Treasury gave their consent. On the other hand, if the present inflated prices were not brought down soon after the war he was sure many local authorities would not persist with any scheme, and so they would have to wait until prices were more reasonable. Mr. Aldridge gave in his paper a very nice list of things in which the powers of local authorities were limited. He had left out, however, one from which he was now suffering. He said: "(6) Local authorities have no power to prevent a house being built upon any spot the owner wished, and may not even insist upon proper access being given to it. The site may be of such a marshy character as to render the maintenance of the proper health of the inhabitants when built almost impossible, but local authorities have no power to prevent this action being taken." He should go on with a No. 7, and say the local authority have no power to prevent the owner building at any level he pleases so long as the floors were the statutory height above the ground on which it was built. The local authority had no power to prevent an owner building a house below the level of the road. In the 1892 Act they had power to prevent him building on land which was likely to be flooded. A house might be built 18 in. or 3 ft. below the level of the road, if it was above the level of the soil. With regard to poor old Dowlais, he thought Mr. Aldridge was going round there to see the worst he could in order to show how bad housing was in this country. They came to Blackpool and saw the glorious front, but if they went into the back streets they might find buildings there of which Mr. Brodie was ashamed. They could find them in every town. He remembered that one of the things he did when a pupil was to prepare a plan of a row of houses—seventy-two houses long. The agent said he would not have a plan with one house at each end and a row of dots between. He

had to prepare a plan 9 ft. long, showing every house. Mr. Shawcross suggested the waiving of unnecessary regulations in building by-laws. He thought Nos. (5) and (6) ought to have some qualification. As to (5), a certain amount of flagging in back yards was absolutely necessary. There should be an area of 70 or 80 sq. ft., or perhaps 120 sq. ft., properly flagged; the rest need not be flagged, but the cottager might make a little garden of it. The other was the excessive height of rooms. That ought to be qualified. He quite admitted if a living-room was 150 ft. in area perhaps a low height was desirable, but if the living-room was only 100 ft. there should be a good height. These two points ought to be qualified.

Alderman MUIRHEAD (Liverpool) remarked that Scotland-road, Liverpool, had been for many years held up as a byword, but he thought anybody who went up Scotland-road any time before the war began found a considerable improvement every time they went there. He was not opposed to town planning in any shape or form; indeed, he claimed to have helped their city engineer in this matter; and it was all very well for Town Planning Associations to talk about the slums in big cities, but his experience of Town Planning Associations up to now was that they did not touch the people who lived in the slums of big cities at all. It was to be hoped they would find some way of dealing with the poorer working population, the men earning 24s., 25s., 26s. and 27s. a week. Those men did not want to pay more than 3s. 6d., 4s. 6d., or 5s. a week rent. The problem was to find houses for that class of people. With all their talk of town planning, they were not getting to the root of the matter. It was no use having town planning to provide houses for clerks or citizens getting £2 or £3 a week. What they wanted was town planning to improve the housing of the very poor, and the health of the children, and he could not see how that was to be done by anybody but the municipalities. All their fine schemes of town planning had, there and everywhere, faded away like smoke when they came to deal with the slums of a big city. It was no use talking about Scotland-road, and places like that, for the town planners had never attempted to do anything for slum dwellers. They had built nice little houses for clerks and people of that sort, for whom private builders could build houses. The provision of wide arterial roads everybody would agree with. They all wanted wide roads. Mr. Brodie and himself were fighting for a very ambitious scheme for a wide road from the docks in Liverpool. On the day that war broke out the chairman of the Finance Committee said to him, "It is no good bringing that forward to-day, for money is in too bad a state." They were all in agreement as to wide roads but the Town Planning Association did not reach the heart of the problem.

Mr. C. W. HALL (Felling-on-Tyne) believed that Mr. Aldridge must have had a vision of his district when he described the industrial villages. A good deal of coal had been taken out of the earth in his district, but they had had no improvement at all commensurate with the amount of money which had been made in the district. In fact, colliery villages were the worst they had in the North. The land was worth anything from 2s. 6d. to 7s. 6d. per yard. He prepared a report and laid it before his council with a plan for improvement, and he was met with this sort of talk—if town planning was of such importance it should be made compulsory, and then they might take it into consideration. That was good evidence in favour of the paper.

Alderman BAINBRIDGE (Stockton) remarked that in a period of unemployment West Hartlepool employed the men who were out of work in the making of good, broad roads. They paid fairly decent wages, and they got something for their money. Stockton did not take up a similar work. They had 600 men out of work and needing relief. The Local Government Board would not allow them to give relief without work, and they advised stone-breaking. The stone cost them 7s. 6d. per ton, and when it was broken they got 1s. 6d. per ton for it; the extra came out of the rates. They learned their lesson. They were preparing a plan for when the men came back from the war, and if necessity arose they would have a plan for work for them, finding two sets of men three days each, and paying them 15s. for the three days' work. With reference to town planning, they had an estate called the Grange estate, and it was one of the best districts he had seen, with some of the best people in this country living in it. There was only one resident in that district of 200 or 300 houses whose garden looked a little bit shabby, and if he was not shamed out he would be pushed out. That district had not cost them anything.

Mr. W. L. CARR (Ruislip-Northwood) said he could not at all agree with Councillor Shawcross as to the question of land units. Members of local authorities and their surveyors might take it from him that his council up to the present time had not in actual practice found very great difficulty in working the land unit in the squares arranged. Mr. Shawcross in his paper had not said in any way really why he could not support it, and he strongly advised all engineers who were going to put down a land unit, until something was found better to work than the Ruislip-Northwood method, to stick to it, because the experience they had had up to the present time was this—that they had been able to work the land unit without any trouble.

(To be continued.)

ANNUAL DINNER.

The annual dinner of the institution was held on Friday evening at the Hotel Metropole, Blackpool, Mr. J. S. Brodie, the president, occupying the chair.

Following the loyal toasts, that of "His Majesty's Imperial Forces" was proposed by Alderman J. Bickerstaffe, J.P. Colonel Charles Brownridge, V.D., in responding, pointed out that the institution had a long list of members in the prime of life who were serving their country at the front, while others of more mature age were doing their bit at home. As a further little indication of their patriotism he might say that the council of the institution, when it was suggested that they should assist in finding work for a certain modern parasitic introduction in the shape of conscientious objectors, declined to do so.

Mr. A. H. CAMPBELL, M.INST.C.E., city engineer of Edinburgh, in proposing "Public Authorities," observed that great and multifarious as had been the duties of those bodies in the past, it was likely that after the war new and greater responsibilities would devolve upon them, and he ventured to assert that when that time came they would not be found wanting.

The toast was responded to by Councillor Marlow Reed, J.P. (Middlesex).

"The Institution of Municipal and County Engineers" was proposed by the Mayor of Blackpool (Councillor R. Holt, J.P.). His Worship remarked that while councillors came and went they found that officials had a way of sticking. There was no doubt that officials were responsible to a very great extent for the welfare of their towns, and people entering a town could form a fairly good idea of the sort of engineer who was in charge of it. In every way there was no doubt the permanent officials had more to do with the progress and making of a town than the councillors. They had had, and had at present, most excellent officers, but none more excellent than their president, Mr. Brodie. In Blackpool they had many amateur engineers who made themselves known when the promenade widening was commenced some years ago, when they said there would not be enough money in Lancashire to do the work, but despite their bewailings, Mr. Brodie went on with his work and completed it as they had seen. In conclusion, his Worship remarked that he had heard conferences such as was being held by the institution at Blackpool that week described as pleasure parties, but his own view was that it was most necessary that such meetings should be held, because they gave them an opportunity of solving most important problems, and in some instances enabled them to save their towns many thousands of pounds, besides developing ideas that it would otherwise be impossible to bring forward.

The President, in responding, observed that among the objects for which the institution existed was the promotion of efficiency among their members, so that they might serve their authorities to the best possible advantage. The institution had contributed largely both to the commissioned and non-commissioned ranks of his Majesty's Forces, but he was able to say that the whole of their 1,800 members had not so far produced a conscientious objector. (Laughter.)

The toast of "The Visitors and Absent Members" was given by Mr. H. F. Gullan, M.INST.C.E., master of works, Belfast, and responded to by Alderman Lloyd, J.P. (Bristol), and Councillor E. Williams, J.P. (Birmingham).

VISITS.

On Friday afternoon a visit was paid by the members of the institution to the adjoining pleasure resort of St. Annes, a cordial welcome being extended by representatives of the local authority. Owing to illness, Mr. J. S. Sawdon, the surveyor to the district council, was, to the general regret, unable to be present to receive the visitors.

ST. ANNES-ON-THE-SEA MUNICIPAL WORKS.

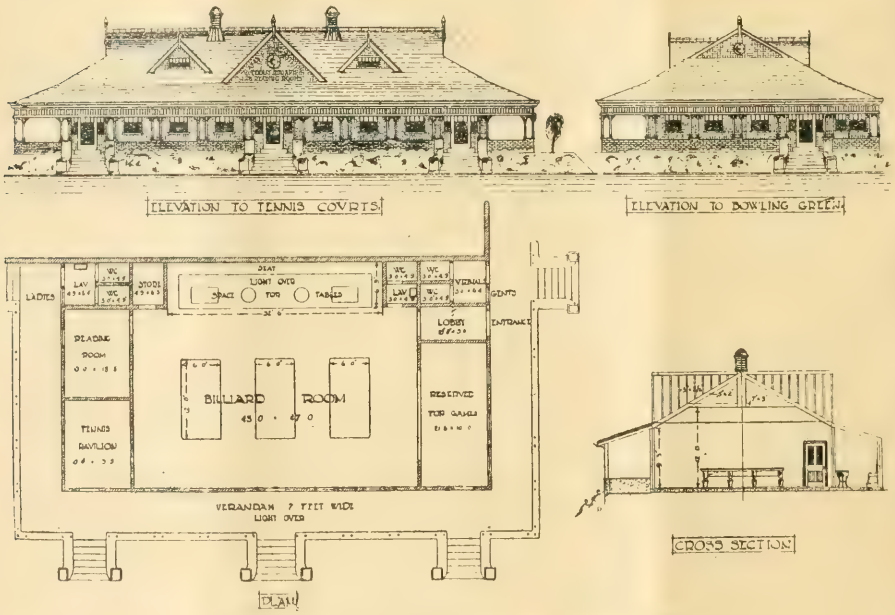
Forty years ago not a single house occupied the site of St. Annes. To-day the value of property in the town is computed at £3,000,000, and the rateable value exceeds £100,000. The population in summer is upwards of 50,000, and in winter about 12,000. The town is situated between Blackpool and Lytham, and is connected with those places by electric tramways. It has been designed on spacious garden city lines. The main street, leading from the railway station to the pier, is 120 ft. in width. There is uniformity in the size of the residences in the various thoroughfares, with a diversity of architecture that is picturesque, imparting an appearance of superiority. St. Annes-on-the-Sea is Lancashire's "Mecca" of golf. There are six courses, with a total membership of over 2,000. The urban council is fully alive to the requirements of an up-to-date town, which possesses admirable public offices, a free library, a technical school, public abattoirs, a fire station, depot buildings, a refuse destructor, open-air sea-water baths, electricity works and ample open spaces. The pier, erected by a company, is claimed to be one of the best equipped marine structures on the west coast.

Ashley Gardens, a beautiful open space of nearly 14½ acres, presented to the town by Lord Ashton, were visited by the members during their stay. The gardens, it may be mentioned, were formally opened on the following day.

When the council in 1914 proposed to purchase this ground at a cost of £26,000, Lord Ashton generously presented the town with a cheque for that amount, and the council were thus enabled to lay out and develop the gardens on a much larger scale than would otherwise have been possible. In the early stages of the scheme a considerable amount of time was taken up in considering the claims of the many tenants in the gardens. A builder's yard, with boiler-house and stables, had to be removed, also a bungalow, a building used as an institute, a large conservatory and greenhouse, and many minor structures. The materials have all been re-used in the several new buildings which have been erected in the gardens, thus producing an economical as well as an efficient scheme. No less a sum than £17,000 has, however, been spent on the works, on which, at one time, 150 men were employed.

Among other objects of interest seen by the visitors were the new open-air baths, an illustrated description of which, prepared by the surveyor, Mr. Sawdon, appears on another page of this issue.

For the following day (Saturday) arrangements had been made for inspections of the garden city at Cleveleys, and of the public works of Fleetwood, Morecambe and Lancaster. When, however, the members assembled in the morning at the town hall rain was falling heavily, and continued practically without cessation throughout the day. As a consequence, until Morecambe was reached, few, if any, of those who formed the party ventured to leave the motor vehicles in which the journey was made. Here, owing to regrettable difficulties which arose in connection with the all-important matter of luncheon—not to mention the weather—there was a general disinclination to go far afield; a considerable number of members, in fact, broke off from the meeting at this point, and, owing to the lateness of the hour, only a comparatively small proportion of those who had started from Blackpool in the morning took part in the concluding visit to Lancaster for the inspection of the new town hall, the Castle, the Williamson Park and Ashton Memorial, and the corporation's mechanical water filtration plant—the last-mentioned of which is described on another page in a paper specially prepared for the occasion by Mr. Arthur G. Bradshaw, F.S.I., the borough and water engineer.



Games Pavilion, Ashton Gardens, St. Annes-on-the-Sea.

ORPHAN FUND: ANNUAL REPORT.

[In their seventeenth annual report to the subscribers the committee entrusted with the management of the Institution Orphan Fund report as under, the period covered by the statement being for the twelve months ended December 31st last.]

The number of subscribers during the year has been 217, from a total of 1,797 members upon the subscribers' list of the institution, whilst twenty-five donations have been received amounting to a sum of £44 12s. 3d., of which £25 11s. 9d. was collected at the various district meetings during the year. The subscriptions amount to £144 12s. 6d., as compared with £133 12s. 6d. in the preceding year, thus showing, notwithstanding the many increased claims incidental

The Surveyor

And Municipal and County Engineer.

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to the War, that the number of our generous friends subscribing to the fund has been maintained.

Grants have been made for the benefit of twenty children, enquiries in each families, each case having been carefully investigated beforehand. In addition, one child was enjoying the benefits of a presentation to the Brinsh Orphan Asylum, which expired on May 15th this year.

The amount of grants made is practically the same as during the past five years, and it is with great satisfaction, combined with thankfulness, that your committee are thus able to report, notwithstanding the large number of members of the institution now serving His Majesty in this terrible war. Let us hope that this immunity from increased grants may continue; but your committee would, nevertheless, earnestly request financial assistance being rendered to the fund by a larger number of subscribers than at present. It is satisfactory to report that the kind advocacy of the district secretaries has been continued on behalf of the fund at some of the district meetings, where collections have been made proving of assistance to the fund, but it is hoped that still further efforts will be made in this direction with a view to augmenting the fund, and that collections are made at all district meetings where possible.

The capital invested at the end of the year 1915 amounted to the sum of £1,098 2s. 4d., according to the market value of the various securities on December 31, 1915, the nominal value being £1,463 10s. 10d.

The total income of the fund during the year has been £227 17s. 10d., as compared with £227 8s. 7d. of the preceding year, whilst the administration expenses have been kept down to an extreme minimum as in former years, and the total amount thus expended amounting to £13 14s. 11d. for the year 1915.

The retiring members of the committee, Messrs. J. W. Cockrill, E. J. Elford, E. Purnell Hooley and E. Willis, were duly re-elected for the year.

Your committee regretfully record the death of Mr. W. H. Leete, county surveyor of Bedford, who has been a subscriber to the fund from the early days.

The proposed Ladies' Committee for rendering assistance has, unfortunately, made no further advance towards any practical result. Possibly this may be due to the great amount of philanthropic work now undertaken by so many ladies throughout the country. With the advent of peace it is not unlikely that some more successful result may be obtained in the formation of a Ladies' Working Committee on behalf of the fund.

In conclusion, your committee would earnestly thank all those members who have extended their sympathy and generosity to the fund, and sincerely trust that the work carried out on behalf of the little ones warrants the approval of the subscribers.

List of Donations and Subscriptions for the Year Ended December 31, 1915.

Name.	Donation £ s. d.	Annual Subscription. £ s. d.
East Midland District.		
Baxter, J. G. R., Grimsby		0 2 6
Bennett, E. H., Derby		0 5 0
Brown, A., Nottingham		1 1 0
Burn, W., Sutton-in-Ashfield		0 5 0
Clare, J., Sleaford		0 5 0
Clare, S. F., Sleaford		0 1 0
Clark, W. G. J., Wigston Magna		0 5 6
Clarke, R. E., Arnold		0 5 0
Clews, C. A., Derby		0 10 0
Coales, H. G., Market Harborough		0 10 6
Cook, F. P., Mansfield Woodhouse		1 1 0
Cordon, R. C., Belper		0 5 0
Crumpp, E. H., Ruckley		0 10 6
Fenn, T., Belper		0 2 6
Haller, J. C., Nottingham		0 10 6
Hawley, G. W., Basford		0 10 6
Henry, T., East Retford		0 5 0
Hooley, E. Purnell, Nottingham		1 1 0
Hopkinson, E., Blyth and Cuckney		1 1 0
Horton, A. W., Derby		0 5 0
Jaffrey, W., Matlock		0 5 0
Kennedy, J. D., East Retford		0 10 6
MacBrair, R. A., Lincoln		0 2 6
Mason, S., Grimsby		1 1 0
Mawbey, E. G., Leicester		0 10 6
Maylan, S., Basford		0 10 6
Oakden, R., junr., Newark		0 10 6
Parker, S. W., Gainsborough		0 10 6
Rawson, G., Worksop		0 5 0
Ross, A. J., Lutterworth		0 5 0
Ryman, F. R., Stamford		1 1 0
Ward, J., Derby		1 1 0
Whyatt, H. G., Grimsby		0 11 0
Wright, W., Grantham		
Eastern District.		
Barrett, E. J., Staines		0 10 6
Brown, R., Southall-Norwood		0 10 6
Coales, H. F., Sunbury-on-Thames		0 5 0
Cockrill, J. W., Great Yarmouth		1 1 0
Collins, A. E., Norwich		1 1 0
Collis-Adamson, A. C., Highgate		0 5 0
Cooper, L. A., Chiswick		0 10 6
Cooper, W. W., Slough		1 1 0
Croxford, C. H., Wood Green		0 5 0
Dunn, J., Chesterton		0 10 6
Elford, E. J., Southend-on-Sea		1 1 0
Farrington, W., Woodford Green		1 1 0
Fisher, R., Willesden		0 5 0
Gregory, W., Hertfordshire		0 5 0
Harrison, P. T., Chelmsford		0 10 6
Haylor, B., Willesden		0 10 6
Hedges, H. N., Berkhamsted		0 5 0
James, A. C., Grays Thurrock		1 1 0
Jevons, J. H., Hertford	1 0 0	
Juhan, J., Cambridge		0 10 0
Killick, J. S., Hertfordshire		0 10 6
Lavender, W. A., Swaffham		0 2 6
Lovegrove, E. J., Hounsey		1 1 0
Morley, E., Walthamstow		0 5 0
Neave, J., Walthamstow		0 5 0
Robson, O. C., Willesden		1 1 0
Smart, F. W., Bedford		0 5 0
Siddons, J. M., Oundle		0 5 0
Smith, F. Hall, Sheringham		0 5 0
Smith, T. R., Kettering		0 10 6
Smith, W. J., Willesden		0 5 0
Smyth, J. H., Willesden		0 10 6
Thomas, R. J., Buckingham		1 1 0
Thompson, W. H., Willesden		0 5 0
Wakelam, H. T., Middlesex		1 1 0
Webb, J., Hendon		0 10 6
Willis, E., Chiswick		1 1 0
Wilson, R. E., Leiston		0 2 6
West Midland District		
Burton, A., Stoke-on-Trent		1 1 0
Butt, E. E. W., Birmingham		0 5 0
Clarry, W. A. H., Sutton Coldfield		0 10 6
Clarson, H., Tamworth		0 5 0
Davis, A. T., Shrewsbury		1 1 0
Douglas, S., Kenilworth		0 10 6
Eaves, T. W., Birmingham		0 5 0
Fiddian, W., Stourbridge		1 1 0
Gettings, C. F., Worcester		0 10 6
Greatorex, A. D., West Bromwich		1 1 0
Green, G., Wolverhampton	2 2 0	1 1 0
Howell, A. P., Birmingham	—	0 5 0
Jack, G. H., Hereford		0 10 0
King, J. Stuart, Birmingham	—	0 5 0
Lacey, G. W., Oswestry		0 10 6
Negus, T. H., Meriden		0 10 6
Perkins, J., Birmingham		0 5 0
Plant, W., Stafford		0 10 6
Richardson, H., Birmingham		0 5 0
Rogers, W. E., Rugeley		0 10 6
Shipton, T. H., Oldbury		0 5 0
Stilgoe, H. E., Birmingham		1 1 0
Watson, J. D., Birmingham		1 1 0
Willcox, J. E., Birmingham	1 1 0	1 1 0
Willmot, J., Warwickshire		1 1 0
Woodward, F., Stourbridge		0 10 6
Metropolitan District		
Barber, J. P., Islington		1 1 0
Bicknell, R. H., Westminster		1 1 0
Blair, W. N., St. Pancras		1 1 0
Boulnois, H. Percy, Westminster		1 1 0
Dodd, P., Wandsworth		1 1 0
Finch, A. E., Kensington		1 1 0
Hayward, T. W. A., Battersea		1 1 0
Higgens, T. W. E., Chelsea		1 1 0
Killick, P. G., Finsbury		1 1 0
Maybury, H. P., Westminster		1 1 0
Moss-Flower, T. J., Westminster		1 1 0
Silcock, E. J., Westminster		2 2 0
Van Putten, E., Lewisham		1 1 0
Willcocks, G. Waller, Roehampton		1 1 0
Winter, O. E., Hampstead		0 10 6

Name.	Donation. £ s. d.	Annual Subscription. £ s. d.
North-Eastern District.		
Beaumont, T. C., Driffield	—	0 10 6
Bryning, W. G., Northallerton	—	2 0 0
Burton, W. F. H., Wakefield	—	0 10 6
Collinge, T. P., Rotherham	—	0 10 6
Dickinson, R., Berwick-on-Tweed	—	0 5 0
Foster, H. P., Leeds	—	0 2 6
Frank, T. P., Stockton-on-Tees	—	0 10 6
Green, W., Castleford	—	0 5 0
Hadfield, W. J., Sheffield	—	1 1 0
Hailstone, T. H., Birstall	—	0 2 6
Hart, G. A., Leeds	—	0 10 6
Haseldine, W. S. T., Wath-upon-Dearne	—	0 5 0
Hewitt, F., Kiveton Park	0 5 0	—
Ives, L., Wakefield	—	0 10 6
Kirby, T. O., Doncaster	—	1 1 0
Lancashire, W. T., Leeds	—	1 1 0
Massie, F., Wakefield	—	1 1 0
Nuttall, J., Hunslet	0 5 0	—
Parkin, J., Dewsbury	—	0 5 0
Rothera, A., Spenborough	—	0 2 6
Senior, S. M., York	—	0 2 6
Steele, W. J., Newcastle-on-Tyne	—	1 1 0
Thackray, F. J., Hoyland Nether	—	0 5 0
Tonge, J. A., Rawmarsh	—	0 5 0
Wakeford, J. P., Wakefield	—	0 10 6
Wike, C. F., Sheffield	—	0 10 6
Collection at Doncaster Meeting, per Mr. J. P. Wakeford	1 10 9	—
Collection at Scarborough Meeting, per Mr. J. P. Wakeford	2 11 0	—
Collection at Brighouse Meeting, per Mr. J. P. Wakeford	2 0 0	—
North-Western District.		
Anonymous	—	0 2 6
Brodie, J. A., Liverpool	—	1 1 0
Brodie, J. S., Blackpool	—	1 1 0
Davies, S. H., Wirrall	—	1 1 0
Diver, D. J., Marple	—	0 10 6
Gooseman, A. T., Wigan	—	0 10 6
Hayes, H. E., Southport	0 2 6	—
Heath, J., Urmston	—	0 5 0
Hellawell, O., Withington	—	0 10 6
Kay, W. R., Isle of Man	—	0 10 6
Martin, E. B., Salford	—	0 10 6
Meade, T. de Courcy, Manchester	—	1 1 0
Platt, S. S., Rochdale	1 1 0	1 1 0
Price, A. J., Lytham	—	0 10 6
Stubbs, W., Blackburn	—	0 10 6
Travers, W. H., Wallasey	0 1 0	0 10 6
Wilding, J., Runcorn	—	0 10 6
Wiles, J. W., Manchester	—	0 10 6
Worrall, E., Stretford	—	1 1 0
Three Assistants, Accrington	0 5 0	—
Southern District.		
Cowan, G., Portsmouth	1 0 0	—
Frost, H., Gosport	—	0 10 6
Goodwin, W. J., Salisbury	—	0 10 6
Guilbert, T. J., Guernsey	—	1 0 6
Hawkins, J. F., Reading	—	1 1 0
Jones, Lieut.-Colonel A. S., Finchampstead	—	1 1 0
Lemon, Sir J., Southampton	—	1 1 0
Mckenzie, L. S., Bristol	—	0 10 0
Phipps, F. R., Basingstoke	—	0 10 6
Pickering, J. S., Cheltenham	—	1 1 0
Read, R., Gloucester	—	1 1 0
Stallard, S., Oxford	0 10 6	1 1 0
White, W. H., Oxford	—	1 1 0
Wrigley, G. E., Banbury	—	0 5 0
Yabbicom, T. H., Bristol	—	1 1 0
South-Eastern District.		
Andrews, S. Percy, Faversham	1 1 0	—
Busbridge, T. A., Maidstone	—	0 10 6
Chapman, H. T., Kent	—	1 1 0
Cooper, C. H., Wimbledon	—	1 1 0
Farnham, W. A., Foots Cray	—	0 10 0
Grant, F. T., Gravesend	—	0 10 6
Jeffes, R. H., Malden	—	0 5 0
Nichols, A. E., Folkestone	—	0 5 0
Norris, J. H., Godalming	—	0 10 6
Palmer, P. H., Hastings	—	1 1 0
Scott, H. H., Hove	—	1 1 0
Weston, G., Bognor	—	2 2 0
Wilkinson, F., Wimbledon	—	0 5 0
South-Western District.		
Braggins, A. D., Newquay	—	0 5 0
Chowins, W. H., Burnham	—	0 5 0
Hutton, S., Exmouth	—	0 10 6
Saunders, E. Y., Barnstaple	—	0 10 6
Welsh District (North).		
England, J., Wrexham	—	0 10 6
Morgan, R. P., Towyn	—	0 5 0
Welsh District (South).		
Bell, G., Swansea	—	0 10 6
Bell, G. H., Swansea	—	0 5 0
Harpur, W., Cardiff	—	1 1 0
Harpur, W. L., Brecon	—	0 5 0
Harvey, T. F., Merthyr Tydvil	0 10 6	—
Holden, L., Llandaff and Dinas Powis	—	0 2 6
Hybart, F. R., Barry	—	0 5 0
Jones, D. L., Merthyr Tydvil	—	0 2 6
Priestly, C. H., Cardiff	—	0 10 6
Read, F., Gellygaer	—	0 10 6
Rimell, H. C., Cardiff	—	0 5 0
Shellard, I. F., Newport, Mon.	—	0 5 0
Wright, F. W., Rhymney	—	0 5 0
Scottish District.		
Campbell, A. H., Edinburgh	—	1 1 0
Dunbar, W., Kilmarnock	—	0 2 6
Ellacott, W. H., Mid-Lothian	—	0 5 0
Smith, P. C., Dunfermline	—	0 2 6
Collection at Ayr Meeting, per Mr. D. A. Donald	8 10 0	—
Irish District.		
McGahon, J. F., Carrickmacross	—	0 10 6
Indian District.		
Barker, H. W., Madras	0 10 6	—
Salkield, T., Delhi	—	1 1 0
Abroad.		
Bush, W. E., Auckland, N.Z.	—	1 1 0
Hamlin, E. J., Stellenbosch, S.A.	—	0 10 6
Miscellaneous.		
Collection at Annual Meeting of Institution, per Mr. J. W. Dudley Robinson	11 0 0	—
Collection, per Mr. T. W. A. Hayward	1 0 0	—
Lower Thames Valley District Surveyors' Association	—	2 2 0
Road Surveyors' Association of Scotland	5 5 0	—
Non-Members of Institution.		
Anonymous	—	1 1 0
Biggs, Mrs., Richmond	—	0 10 6
Carpenter, F. G., Wakefield	—	0 10 6
Cole, T., Westminster	—	1 1 0
Giles, H. A., Westminster	—	0 5 0
Howard, H., Littlehampton	—	0 10 6
Mansergh & Sons, Westminster	—	1 1 0
Mouchel & Partners, Limited, L. G., Westminster	—	5 5 0
Public Works Magazine, per Mr. C. S. Mason	2 12 6	—
Robinson, J. W. Dudley, Westminster	—	1 1 0
Renwick, R., Horsham	0 5 0	—
Editor, The Surveyor	—	5 5 0

A TACTLESS PROCEEDING.

In an editorial under this heading, the *Surrey Comet* of Saturday last deals with a discussion which took place at the last monthly meeting of the Kingston Town Council, at which allegations, for which there was not the slightest foundation, were made against Mr. R. Hampton Clucas, the borough surveyor, and by implication against some member of the town council who was not named.

"The facts," says our contemporary, "were quite simple, and nothing was revealed that was to the discredit of the persons concerned. It seems that one of the principal ratepayers of the borough wished to improve the approach to his business premises and, as the corporation had a large quantity of granite which had been taken off the roads where wood blocks have been laid down, he asked the surveyor to let him have a few loads of the material and the loan of the steam roller to roll it in, offering to pay whatever sum was charged for the material and the work. The surveyor treated the matter purely as a business transaction, furnished the accountant with the details, and the account for the granite and the use of the steam roller was rendered and paid; and there the simple transaction should have ended. But some anonymous individual suggested to Councillor —— that there had been a corrupt transaction, and that credulous councillor proceeded to act upon the assumption, and with almost incredible tactlessness pursued his investigations. The matter was fully thrashed out by the Highway Committee, and every member except Councillor —— was satisfied with the explanation given. But Councillor —— was apparently determined to go the whole length which his folly had dictated, and on Tuesday evening he had the temerity to propose that the salary of the surveyor be reduced by £50 a year. The insincerity of the whole business was shown by the fact that in the end he did not even vote for his own resolution, which was deservedly and ignominiously rejected. The burden of Councillor —— lament was that he was refused access to the books in which the transaction was recorded, but it was shown that this was due to the fact that he would not reveal the name of the person who brought the unfounded charge against the surveyor. Taking the most charitable view of the conduct of Councillor ——, one can only say that he displayed deplorable lack of judgment in listening to such tittle-tattle concerning an officer who has won in an unusual degree the confidence and esteem of the members of the council and the burgesses, and whose honour he ought to have been one of the first to defend."

The Bradford-Shipley-Bingley Town Planning Scheme.—A conference of representatives of the Bradford Corporation and the Shipley, Bingley, and Clayton Urban District Councils was held at the Bradford Town Hall on Tuesday, to consider the suggested town planning scheme involving a large undeveloped area to the west of Bradford within the districts mentioned. The plan is to be called the Bradford, Shipley, Clayton, and Bingley Town Planning Scheme, and it was approved, subject to any slight alterations as to boundaries.

The Alignment Diagram Applied to the Flow of Water in Uniform and Compound Mains.

DISCUSSION OF MR. HALTON THOMSON'S PAPER AT THE INSTITUTION OF WATER ENGINEERS.

The following discussion took place at the recent Summer meeting of the Institution of Water Engineers, following the presentation by Mr. D. Halton Thomson, M.A.(CANTAB.), ASSOC.M.INST.C.E., of a paper entitled "The Alignment Diagram Applied to the Flow of Water in Uniform and Compound Mains." The paper was reproduced in our issue of last week.

Mr. E. J. Silcock said he had great pleasure in proposing a vote of thanks to Mr. Thomson for his paper. It seemed to be an exceedingly ingenious system of calculation, and one which certainly facilitated calculations in connection with the discharging capacity of a network of mains in a most admirable manner. The introduction of the factor of carrying capacity and of obstructive power gave them a method of manipulating these sort of problems which they had no knowledge of before. The only criticism which he had to offer on the diagrams and the system generally was that the nett results of discharging capacity in the examples given did not seem to conform with the results obtained by the formulæ in common use. No doubt that was due to the formula on which the diagram was based. He was not familiar with the particular formula, but, taking Kutter's formula with a coefficient of 0·013, which in his experience gave the most accurate results for the discharge of water mains, and working out the examples (1) and (2) given in the paper it appeared in the example No. 1 there were 4 cub. ft. discharged by the author's diagram. Kutter's formula gave 3·75, which was pretty near. It showed only a difference of about 7 per cent too high. But in example (2) the discharging capacity varied to a much greater extent—viz., to 27 per cent too high. He tried two other examples in order to see how they would compare, taking what might be called normal conditions—viz., a 24-in. pipe with a fall of 5 ft. per mile, and there the discharging capacity was almost identical, only a difference of about 1 per cent. Taking the other example a 3-in. diameter pipe with a loss of head of 20 ft. per mile—in that case the author's diagram gave a discharge of over 50 per cent in excess of Kutter's formula. There must be some reason for this, and it appeared as if the formula on which the diagram was based agreed with Kutter's formula for large pipes, but did not agree for small pipes and for large heads. If he might make a suggestion to the author, he thought he would render them all a great service if he would reconstruct his diagram upon Kutter's formula, because, as he had said before, that gave them most accurate results. It was a very inconvenient formula to work with, and would probably involve him in a good deal of labour; but if he would give them a fresh diagram based on that formula, and would have it put into such a form that they could have it printed on cardboard, so that they could have it to use in a convenient way, he would be doing them a great service.

Mr. C. H. Roberts (Aberdeen) said he would like to add his thanks to those of the last speaker to the author for having put forward what he had rightly described as a comparatively new diagram. He thought a great deal of courage was required to bring forward anything which was at all new, in view of possible criticism. Of course, the alignment diagram had been in use in America and on the Continent for some years, but they had to thank the author for suggesting this new extension of it—the carrying power and the loss of head and the length. He regretted that he had not been able to give a careful study to the paper, but he was sure it would repay very careful study. He could say he had used a modification of the diagram which Prof. Turneaure referred to in his book, and which the author also referred to. Dr. Turneaure's diagram was a four-line diagram. It gave the discharge and the diameter and hydraulic gradient, and another factor, which he believed was velocity—a very useful line in dealing with pumping supplies more particularly in regard to gravitation supplies. Some years ago from the book of Dr. Turneaure he made a little diagram for himself with three lines—discharge, diameter and hydraulic gradient—and using another formula. With regard to the extension of the diagram proposed by the author, he supposed it was submitted for discussion as to its usefulness, and personally he was a little sceptical as to whether it would save much work in calculation. The practice of the water engineer was to use diagrams very largely. He had a little diagram which he dare say was known to most of them. It was a diagram prepared by Prof. Alexander a few years ago, and was a very useful one. It enabled one to deal with the discharge of gallons per hour, the gradient, the velocity, and the size of pipes. As he had said, he had not gone into the paper very carefully, and perhaps if he had done so he might think differently, but he would not be inclined to add more complexity to a diagram than could be avoided; compound pipes could be calculated so conveniently by the trial and error method with the aid of a diagram. There were, for instance, the last two columns; the author had taken them through two examples for uniform pipes in which he used the last two columns, and if they looked at the examples it would be seen that the author got the hydraulic gradient by them. But the hydraulic gradient could be got mentally at once, so that the two last columns were unnecessary for uniform pipes. With regard to the remarks of Mr. Silcock, he agreed in what was said about the use of the formula employed, but he rather joined issue with him as to the correctness of the results. Of course, as the author had explained, the formula which was the basis of the diagram had taken into consideration 30 per cent loss in discharging capacity due to corrosion, and therefore it could not be compared with Kutter's formula with a coefficient of ·013, which applied to new pipes. It was naturally a matter of opinion as to what formula should be used, but he agreed with Mr. Silcock in this respect that it would be desirable for general use to base a diagram on a forumla giving a discharge on *new* pipes, and to allow any reduction of capacity to be allowed for by the engineer using the diagram. That, it seemed to him, was the proper and necessary thing to do. He supposed each of them followed various ways of calculating the particular pipes they had to deal with according to size, number, class of water, and other things; but if a diagram based on a formula such as Kutter's, taking a coefficient of ·013 could be applied, it would be rather useful. There were other formulæ in use in this country, such as the Hagen-Williams, which Prof. Alexander based his diagram on, Hamilton Smith's, and others. There was also the Lawford formula, which was suggested in a paper read before the Institution of Civil Engineers some years ago, and which was referred to in Prof. Goodman's text-book. He put forward these remarks tentatively as to the usefulness of the carrying-power line; there was no doubt that as a mathematical and interesting addition to the diagram the extra three lines would be useful, but from the practical point of view, where they had got to deal with more or less defined factors, it did not appear to him (although he did not wish to discourage the author) worth the extra complexity. In the diagram put forward by Prof. Turneaure, which the author had referred to, there were four columns, and a straight edge put across the diagram ruled off the answer to any problem in uniform pipes directly, and there was no need for the use of a key.

Dr. Herbert Lapworth (Westminster) said he did not think the author of the paper claimed any originality with regard to the alignment diagram because he gave them a bibliography of the method, but what was new was its application to compound mains and networks of mains, and he had followed the author's explanation that afternoon with profound admiration. He thought it most ingenious and clever, and he ventured to think that once it was thoroughly understood it would be of great practical importance. The only point on which possibly one might have a long discussion was the question of choice of formula, and

there he supposed they would all differ as to the proper formula to be used. Some years ago he had to go into the question of the design of pipes in sizes varying from 4 in. to 45 in. diameter, and he secured all the reliable experiments on existing mains that he could. He came to the conclusion in the first place that it was a mistake to cut down the diameter of the mains too small, or, at any rate, not to give a good margin. Another conclusion he came to was that the quality of the water was a factor which had to be taken into account—that was to say, whether one was dealing with hard or with soft water supplies—because it appeared to him, looking at the results of experiments, that the deterioration when dealing with soft or moorland water supplies was much greater than with a hard water supply. Then in the design of a main, should not one consider the period to which one was looking forward? Did one want a main to have the estimated full discharge at the end of fifteen years or thirty years, and should one not design the main accordingly? It seemed to him that was the whole point on which one based one's decision in the design of mains. After a good deal of research he came across a book which was practically unknown, and this was the two volumes of Professor Fidler on "Hydraulic Calculations." Professor Fidler devoted the whole of the second volume to the flow of water in pipes and channels, and derived a general formula of a new type. All previous logarithmic formulæ were similar in the sense that they had three constants, such as in Mr. Thomson's formula were represented by k, m and n. These were never constant by any means, and different mathematicians had derived different values for the same experiments. What Professor Fidler found on studying the matter very carefully was that there was really a definite relation between these three coefficients or indices, and that there was no need to use more than one index, which was actually an index of the roughness of the pipe. There had been numerous books on hydraulics since 1902, and many papers had been written giving new formulæ, but not one of these text books gave a single reference to Fidler's work. He did not think there was anything simpler or more reliable than the work published by Fidler in 1902, and he felt that it deserved recognition. Using the same terms as the author did, Fidler's formula was:

$$i = \frac{1}{1{,}000{,}000}\left(\frac{36{\cdot}84\,q}{d^{\frac{8}{3}}}\right)^{x}$$

or using logarithms $x = \dfrac{\log i + 6}{\log q - \frac{8}{3}\log d + 1{\cdot}566}$

For new pipes: $x = 1{\cdot}76$, and for incrusted pipes, $x = 1{\cdot}95$; the latter giving practically the same results as Unwin's formulæ for incrusted pipes. In regard to hard water supplies, he found that after the mains had been in use for some years, x amounted to 1·85 or 1·90. Taking the author's formulæ for compound pipes, he found the equivalent value of x to lie between 1·80 and 1·85; so that it looked as if it was a little on the fine side, and certainly it gave low results for incrusted mains. But as to this question of hard water, the author was more qualified to speak on it than he was. He would, however, like to know from the author's experience of these chalk waters what index he got, and whether his formulæ was based on his own experience of this class of water. So far as he could make out, the author's formulæ would be applicable to a pipe which had been in use ten or fifteen years with a moorland water supply. It would be very interesting if members who had taken measurements of the discharges of their own mains would see what index they got, and contribute that information to the discussion, because the diagram with the paper really depended on the author's formulæ as to its direct use.

Mr. C. Clemesha Smith (Wakefield) thanked the author for the way in which he had presented the matter and for the very lucid explanation he had given. It had helped him to see many new points which he could not gather from one reading of the paper. But there was one point they wanted to be careful about, and that was the risk involved in assuming values for the internal roughness of cast-iron pipes which had been some time in use, and especially those which had been used for the passage of soft water. He had got nothing but discordant results from calculations he had made dealing with the carrying capacity of old pipes, and had he been dependent solely on calculations and assumed the value of the roughness of the pipe he would at times have gone hopelessly astray. So far as he could see ordinary experience showed that when they were dealing with cast-iron pipes which had been laid twenty, thirty, forty or sixty years they could only get the delivery of the pipe by actual experiment and not by calculation. He had a rather curious case some time ago when he had to deal with a network of pipes about seven miles in length. The system consisted of the following sections in series: (1) An 18-in. main, 1 mile in length, twenty-six years old. This main was partly used as a distributing main in the town and partly as a trunk main carrying water to districts beyond the town. For present purposes we are concerned only with its value as a trunk main. (2) Two parallel mains connected to the end of the 18-in. main, 15-in. main, ¾-mile in length, fifty years old; 12-in. main, ¾-mile in length, seventy-four years old. (3) A 15-in. main, 30 yds. in length, twenty-six years old. (4) Two parallel mains connected to the end of the 15-in. main, 12-in. main, ¾-mile in length, fifty years old; 10-in. main ¾-mile in length, seventy-four years old. (5) An 18-in. main, 3 miles in length, twenty-two years old. (6) A 15-in. main, 1¼ miles in length, twenty-two years old. At eleven points on sections 2, 3, 4, 5 and 6, bulk supplies were drawn and all were metered. The problem to be solved was what would be the increase in pressure at the end of the system if an additional main of given diameter were to be laid from end to end parallel to the existing pipes. The eleven metered supplies were read simultaneously for 12 hours at intervals of five minutes. From these readings diagrams were prepared showing the fluctuations in the delivery of each section. Recording pressure gauges (tested before use against a mercury column) were fixed at the beginning and end of the system and at various changes in diameter. This experiment was repeated several times, and from the information thus obtained the effective diameters of the different lengths were calculated. The effective diameters of the system being known, it was a simple matter to calculate the effect of laying auxiliary mains of different diameters. A new 18-in. main was laid from end to end and the minimum pressure at the extreme end of the system was found to be within 3 lb. of that calculated. The crux of the whole matter lay in ascertaining what was the actual delivery. Some of the older pipes did not appear to have been incrusted any more than those which had been laid thirty or forty years later. In the case of soft water there appeared to be a period when they got a maximum amount of incrustation, and somehow or another they could never tell when the incrustation was going to stop growing. It depended upon several factors—the material of which the pipe was made, the quality of the water and the velocity at which it passed through. It is impossible to estimate accurately the coefficient of roughness of a pipe which had been carrying a soft water for a considerable time. On the whole he considered that if the alignment diagram had been based on calculations for new internally coated cast-iron pipes it would have been of greater value.

Mr. Binnie asked Mr. Smith how much the carrying capacity had fallen off in the older pipes. Could he say what was the percentage of falling off?

Mr. Clemesha Smith said that, speaking from memory, he believed where they were laid together in parallel, a 12-in. pipe seventy years old and a 15-in. pipe of fifty years, the two together were equal to something like a 15-in. new pipe. He could not give them separately as the two were not taken separately.

Mr. J. S. Pickering (Cheltenham) said it appeared to him that the line p on the diagram, which represented the total frictional resistance of the mains under consideration, was much too short to make the diagram as a whole of any practical value. The line was divided to six places of decimals, and it was obviously quite impossible to read such minute divisions with accuracy, and any inaccuracy would affect the results appreciably. The line could not be lengthened without making the diagram of an unworkable size, and he would therefore like to ask the author whether this did not vitiate the use of the diagram altogether.

Mr. W. J. E. Binnie (Westminster) said he did not know whether he would be in order in making any remarks on the subject of corrosion. He lately had been having some experiments carried out for determining the effect of the rate of flow in pipes in corrosion, because he had to put in a steel pipe, and was anxious to see what effect the rate of flow had on the corrosion of steel, which was a more important

smaller than 3 in. the use of cast iron. The results obtained were very erratic indeed. With a still water in the pipe one got a certain corrosion. When the velocity was at the rate of about 1 in. per minute, one got a very much higher rate of corrosion—four times the amount of corrosion in still water, and nearly double the rate of corrosion occurred when the flow got up to a velocity of 4 ft. per second. That was to say, the maximum rate of corrosion was with a very slow flow. The results confirmed the experiments which had been carried out by two German chemists. The experiments carried on at Ilmenau were carried out by Dr. Blount, who had not before him the results of those German experiments, which confirmed them exactly as to the effect of the rate of flow. When the flow was *nil* there was minimum corrosion; when it was slow it was at its maximum.

Mr. A. B. E. BLACKBURN (Sunderland) considered the paper a very valuable addition to their "Proceedings." In reading it through he was a little puzzled at first as to what "*s*" meant, but the author had now made it clear. He defined it as the obstructive power, but did not mention the word in the paper. There had been some discussion with regard to corrosion, but he would like to know whether those taking part in it referred actually to corrosion or to incrustation, because they were two different things.

Mr. BINNIE said he was referring to corrosion, but corrosion was accompanied with incrustation in the case of steel.

Mr. CLEMESHA SMITH: In my case it was almost entirely incrustation. I thought I used that word.

Mr. BLACKBURN thought it would be better if the word incrustation were used where incrustation was actually meant. The author in reading his paper also summed up with one or two rules which he suggested should always be borne in mind. It would be useful to have these rules included in the body of the paper.

Mr. D. HARDEN THOMSON, in reply thanked the members for the manner in which they had received the paper. They would understand that the only points as to which he claimed anything new was the introduction of the carrying-power scale and its use in calculating the loss in compound mains. The rest of the diagram had been published not in identical form, but in similar form, in more than one publication. There had been considerable discussion as to the types of water to which the diagram immediately applied. When he first calculated the diagram he naturally adapted it to the kind of water with which he had to deal—that was a hard, chalk water. Later on, when he commenced to write the paper he did consider whether it should be redrawn so as to suit other types of water; he came to the conclusion, however, that as members had to deal with so many different kinds of water it would be hopeless to attempt a diagram which would comply with all their individual experiences; he therefore decided to leave it in its original form. He was surprised to hear Mr. Silcock say he used Kutter's formula, because modern experiments showed that although that very complicated formula agreed very well with the flow in large pipes, yet in the case of small pipes it was most unreliable. Of course, he (Mr. Silcock) might have had to deal with some class of water to which it by chance applied. Personally he preferred to express all flow by some kind of logarithmic formula which could be made to apply to a great variety of conditions. He was very interested to see the formula of Professor Fidler mentioned by Dr. Lapworth. He had not heard of it before, and there was no doubt that a formula of that kind could be drawn on the alignment system. In order to apply this system the formula used must be of the logarithmic form; it would be impossible to draw an alignment diagram for Kutter's formula suitable to calculate the flow in compound mains. There was no reason why a scale for velocity should not be introduced, but as it was not essential to calculating the flow in compound mains, and with the idea of keeping the diagram as simple as possible, that scale was omitted. One speaker asked whether it would not be better to omit the loss of head and length scales. Of course, for calculations which applied to single uniform mains these scales were not necessary since the calculation of the hydraulic gradient from the loss of head and length of mains was so simple, but when they came to deal with compound mains the loss of head and length were connected separately with the other scales. They saw from the key diagram they had that it was necessary to combine head with discharge and the length with diameter.

Mr. ROBERTS said he meant to refer to the loss of carrying-power line for calculating compound pipes.

Mr. THOMSON, continuing, said he regretted not having introduced the term "obstructive power" for the *s*-scale into the paper as printed. As a matter of fact, it was an afterthought, and when the expression occurred to him it was too late to make an alteration. He was glad, however, to note that now he had interpolated the term when reading the paper, it made the meaning of the *s*-scale very much clearer, and gave a mental picture as to what that scale measured. The last speaker asked whether, owing to the very large range covered by the *s*- and *p*-scales, the diagram was really of any practical use. He thought he could make the point clear by saying that the carrying-power axis and scale were only the means of connecting various values on other scales across the diagram. The actual reading on that scale was not of importance. They would notice in all calculations where the *p*-axis was used it was only a means of fixing the direction of the index-line; it was necessary merely to read the scale as accurately as possible by eye. The more accurately that was done the more accurate was the direction of the index-line.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

LOANS SANCTIONED.

Erith U.D.C. £1,233 for works of sewerage.

Stoke-on-Trent T.C. £12,000 for electricity plant.

Upton-upon-Severn R.D.C. £1,511 in connection with the Kempsey sewerage scheme.

LOANS REFUSED.

Prestatyn U.D.C. £30,000 for a sewerage scheme.

Southgate U.D.C.—£650 for the purchase of a steam roller.

FORTHCOMING INQUIRIES.

JULY.	£
11.—**Aylesbury.** For the electricity undertaking (Mr. A. G. Drury)	
12. **Chatham.** For sewerage and sewage disposal works (Mr. A. G. Drury)	

Women as Cemetery Workers.—At the inspection of the public parks and cemeteries of Greenock last week it was stated that the experiment of employing women in the cemetery had turned out extremely well. There were now nine women working there.

Cornwall Road Surveyors and Military Service.—At the sitting of the Cornwall Appeal Tribunal at Truro on Friday last, the county surveyor, Mr. L. D. Thompson, appeared on behalf of the Cornwall County Council in support of the appeal of Mr. George Palmer, district county surveyor, against the decision of the Redruth Tribunal to grant no further extension of exemption. It was contended that Mr. Palmer had special qualifications, and had charge of 180 miles of main roads, on which there was an annual expenditure of £22,000. The maintenance of the main roads was a matter of great national importance, and he could not be replaced at present without detriment to the national interest. Mr. Thompson said that in other counties district surveyors had been granted total exemptions, and so had many surveyors of rural councils in this county. He could not say that any actual steps had been taken to find a substitute, but that did not mean that the question had not been considered. The military representative said he did not object to three months' exemption, but thought an effort should be made to see if a substitute could be found. Mr. Pearce: Would it not be to the national benefit that the man should remain and look after this length of road? Colonel Williams: I don't think there is much in that. There are a great many road makers. The tribunal decided to grant exemption to September 30th, Colonel Williams remarking that they wished to lay stress on the fact that no effort had been made to find a substitute for Mr. Palmer. The three months would be final. The clerk: The decision is that there can be no application for extension without leave.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Cardiff T.C.—The Property and Markets Committee have offered a site in Cathays Park to the Glamorgan County Council for the county education department at the price of £5,000 an acre.

Essex C.C.—The Education Committee have decided to build a secondary school for boys at Romford to accommodate 200 scholars.

Gateshead T.C.—At the last meeting a letter was read from the Carnegie United Kingdom Trust offering Gateshead £15,000 for a new library building, on the usual conditions, and the Finance Committee will consider and report on the offer.

Guildford R.D.C.—The surveyor, Mr. J. Anstee, reported that the total cost of reconstructing Broadmead Bridge had amounted to £1,709, and of Cartbridge, Hatch, and Round Hole Bridges £1,544, being a saving of £152 and £279 respectively on the estimates.

Newton Abbot R.D.C.—The council have referred the question of the provision of a small-pox hospital to the Joint Isolation Hospital Committee.

Prestatyn U.D.C.—The Local Government Board have written stating that they do not regard the present time as opportune for undertaking the erection of a public abattoir, and are not prepared to entertain an application for sanction to borrow money for the purpose.

Torquay T.C.—The town council on Tuesday passed a resolution welcoming the proposal of the county council to erect a technical school in the borough, and stating that they were prepared to offer a site in the Upton Valley for the building. A resolution was passed instructing the town clerk to take a poll of the borough to obtain the burgesses' instructions whether the pavilion should remain in the hands of the council or whether the building should be let on lease.

HOUSING AND TOWN PLANNING.

Dudley T.C.—The town council on Tuesday adopted a resolution that the Public Works and General Purposes Committee or a special committee should be empowered to take the necessary steps to prepare a town planning scheme. Alderman Cook, proposing the resolution, said the scheme would relate only to those portions of the borough not at present built upon. The borough consisted of 3,500 acres, of which about 1,000 were built upon.

MOTOR TRANSPORT.

Birmingham T.C.—The city council on Tuesday authorised the Lighting, Stables, and Refuse Disposal Committee to purchase, at a cost not exceeding £530, a motor-car for the exclusive use of the stables and veterinary department.

Blackpool T.C.—A motor lorry is to be purchased for the delivery of coke, and a coke-loading machine.

Brighouse T.C.—The purchase of a motor wagon is being considered by the Highways Committee.

Burnley T.C.—The town council have decided to purchase another Leyland petrol tipping-wagon, at a cost of £792, for the cleansing department.

Ilford U.D.C.—It has been decided to purchase a road sweeper at a cost of £673; also a petrol motor chassis and cylindrical tank to hold 800 gallons, at a cost of £900.

Pudsey T.C.—It has been agreed to purchase a petrol motor fire engine.

Southend T.C.—The Economies Committee recommend the town council to extend the use of motor vehicles.

REFUSE COLLECTION AND DISPOSAL.

Southwick U.D.C.—The council have approved a recommendation of the Sanitary Committee to collect house refuse twice weekly during the summer, at an extra cost of 30s. weekly.

Wrexham R.D.C.—Owing to the unsatisfactory nature of the system of refuse removal, the medical officer of health (Dr. T. W. Jones) and the sanitary inspectors have been asked to advise upon a scheme for dealing with the matter.

ROADS AND MATERIALS.

Andover R.D.C.—A scheme has been agreed to for making up the district road at Tidworth, at an estimated cost of £1,361, the greater proportion of which will be paid by the War Office.

Ayr C.C.—At a meeting of the Ayr District Committee of the county council on Tuesday, Mr. Allan Stevenson, the surveyor, stated that his estimate of the expenditure that would be necessary on the district roads during the year ending May 15, 1917, was £10,907, as against £11,266 last year.

Barnstaple T.C.—The town council have accepted the tender of the local gas company for a supply of tar at 2¾d. per gallon. The other tenders were: Exeter Gas Company, 2⅞d. per gallon; Ilfracombe Gas Company, 2⅝d.

Egham U.D.C.—The council have agreed to contribute a sum not exceeding £200 towards the county council scheme for the reconstruction of the Lower Windsor road, near Old Windsor.

Epsom U.D.C.—The surveyor, Mr. E. R. Capon, submitted correspondence with reference to repairing Woodcote-road and South-street, damaged by military traffic, and as the Road Board stated there was no reason why the council should not carry out the necessary reinstatement, although the War Department had not yet agreed to the terms, he was directed to proceed accordingly.

Faversham R.D.C.—Government grants of £200 and £290 have been received in respect of repairs to Harty and Uplees roads.

Holmfirth U.D.C.—The council have resolved to purchase property in Towngate for a widening scheme.

Middlesex C.C.—The tender of Tarmac, Limited, at £1,896, or 5s. 5d. per super. yard, for the resurfacing and the maintenance for three years of the Kingston and Staines main road at Hampton, has been accepted. —The total of the fees received under the Motor-car Act since it came into force in 1904 is £39,958.

Oswestry T.C.—The town council have approved a scheme for widening Whittington-road.

Sleaford R.D.C.—A committee has been appointed to consult with a representative of the Road Board with regard to the repair of the Cranwell road.

Strood R.D.C.—The council have agreed to the Road Board scheme for the repair of the Rochester-Cliffe road.

West Ashford R.D.C.—The Road Board have received the sanction of the War Office to the settlement of the council's claim of £300 towards the cost of the works on the Great Chart-Pluckley road. The total estimated cost is £524.

Wrexham R.D.C.—The council at their last meeting decided to adhere to the original scheme of road improvement and tarring, despite the fact that the Road Board grant to the county council had been reduced from 50 per cent to about 25 per cent.

Wrexham T.C.—It has been agreed to carry out repairs in Mount-street and Salop-road at an estimated cost of £150.

SEWERAGE AND SEWAGE DISPOSAL.

Manchester T.C.—The Rivers Committee are making application to the Treasury for permission to proceed with a part of the main drainage scheme, at an estimated cost of £101,000.

Northampton T.C.—The General Purposes Committee have approved the plan and estimate (£4,650) of the borough engineer, Mr. A. Fidler, for the construction of a sewer and surface-water drains in London-road, and for two surface-water drains in St. Leonard's-road.

Petersfield R.D.C.—The Local Government Board have sanctioned the raising of a sum of £1,200 for the scheme of sewerage disposal for the parish of Liss.

Prestatyn U.D.C.—The Local Government Board

have written approving the proposed sewerage scheme, subject to certain slight alterations, but intimating that a loan for the work could not be sanctioned under existing conditions. The scheme is estimated to cost £30,000.

Trowbridge U.D.C.—The Sewage Disposal Committee reported that the surveyor, Mr. H. Lailey, had submitted plans of proposed lagoons for the treatment of sludge, and after he had explained the proposals and the alternative method of dealing with the sludge by trenching it was resolved that the lagoon method be provisionally approved, the surveyor to submit a more detailed scheme at the next meeting.

Windsor R.D.C.—The Local Government Board have written consenting to the proposed modification in connection with the scheme of sewerage and sewage disposal for Sunninghill and Sunningdale.

WATER, GAS, AND ELECTRICITY.

Belfast T.C.—The gross profit of the gas undertaking for the year amounted to £84,000, and the nett profit to over £62,000, out of which £21,000 will be set apart for relief of rates.

Finchley U.D.C.—It has been decided to provide an overhead cable, at a cost of £75, to supply workmen's dwellings with electricity.

Gloucester T.C.—The ordinary charges for electric current for lighting and power purposes will be increased 20 per cent forthwith.—It has been agreed to increase the street watering of the main roads, and the Streets Committee will consider the question of watering the side streets.

Goole U.D.C.—The report of the gas undertaking for the year ended March 31st last shows a loss of £2,742, which is equal to a rate of 10d. in the £. The loss is accounted for chiefly by reason of a decreased consumption, due to carrying out the lighting restrictions for street lighting and business premises, the increased cost of coal, and the rise in wages of, and war bonuses to, the workmen. There was a profit on the water undertaking of £500.

Kingstown U.D.C.—Negotiations have been completed for a loan of £6,000 to meet the preliminary costs in connection with the electric lighting scheme.

Kirkcaldy T.C.—It has been agreed to increase the price of gas by 4d. per 1,000 cubic feet, making the rate 4s. 9d. per 1,000.

Leek U.D.C.—A new gas engine and dynamo of about 200-kw. is to be purchased for the electricity undertaking.

Lynton U.D.C.—The council received recently a report of a water diviner in reference to a water supply for the isolation hospital, and agreed that the surveyor, Mr. Walter Yeo, should sink a well at the spot indicated.

Nottingham T.C.—The revenue account of the electricity undertaking shows that the sale of current yielded £106,938, and that the expenditure was £69,487, £30,171 being for coals, and £13,909 for rates and taxes. Of the balance of £40,057, £5,000 was contributed to the general district rate, £6,677 was transferred to the reserve fund, and the remainder went in the payment of interest and the repayment of loans.

Paul U.D.C.—Messrs. Douglas, Lewis & Douglas are preparing a report on a proposed water supply for Paul and Newlyn.

Ripon T.C.—A resolution has been adopted to apply for a Provisional Order authorising the town council to provide a supply of electricity.

Spenborough U.D.C.—In connection with the arbitration between the urban council and the Bradford Corporation as to the sum to be paid by the former authority for a supply of water in bulk from the city, the arbitrator, Mr. G. J. Talbot, K.C., has settled the price at 7d. per 1,000 gallons. This sum is intended to represent the cost to the corporation of the water supplied by the corporation to the council, including payments to sinking funds in respect of loans, but without any addition in respect of risk, profit, or otherwise.

Walthamstow U.D.C.—The Finance Committee recommend the council to apply for a loan of £450 for the installation of automatic switches for the public lamps.

West Penwith R.D.C.—The council are negotiating for a site adjoining Withen Well for the proposed reservoir in connection with the Carbis Bay water supply.

MISCELLANEOUS.

Bermondsey B.C.—It was reported that the Horse Committee had paid £97 for a horse. A councillor said the horse was not at all dear, and if the council did not want the animal he would be very pleased to have it.

Spenborough U.D.C.—A committee has been appointed to report upon the provision of fire appliances for Liversedge.

Road Maintenance Unnecessary.—A member of the Lleyn, Carnarvon, Rural District Council, referring to a resolution of the council releasing the roadmen for two months to assist farmers with the harvest, said he thought they should be suspended for twelve months. In war-time road maintenance should be dispensed with, like other things.

FOR OTHER ADVERTISEMENTS
See End of Paper.

COUNTY OF SOUTHAMPTON.

Applications are invited for the temporary appointment of Draughtsman in the County Surveyor's Office, at a salary of £130 per annum.

Applications, stating age and experience, and enclosing copies of not more than three recent testimonials, to be delivered to the County Surveyor, The Castle, Winchester, not later than Monday, the 17th July, 1916. Original testimonials must not be sent, as they will not be returned. (3,038)

BOROUGH OF EALING.

The Town Council of the Borough of Ealing invites Tenders for the Supply of—

1. Household Coal.
2. Coke.

Printed Forms of Tender, Conditions of Contract, and full particulars may be obtained on application to the Borough Surveyor, Mr. W. R. Hicks, ASSOC.M.INST.C.E., at his Office, Town Hall, Ealing, W.

Tenders (in the envelopes provided) to be delivered at the Office of the undersigned not later than 9.30 a.m. on Monday, the 17th July, 1916.

The Council does not bind itself to accept the lowest or any Tender, and any person whose Tender may be accepted must enter into a proper Contract with, if required, two Sureties to be approved by the Council.

The Tenderer whose offer is accepted shall be held to have bound himself to an agreement, and may be compelled to carry out the obligations arising from his Tender, even though he may not have signed a formal Contract.

(By order)
GEO. E. BRYDGES.
Town Clerk.

Town Hall,
Ealing, W.
July 6, 1916. (2,039)

BOROUGH OF EALING.

The Town Council of the Borough of Ealing hereby invites Tenders for the Supply and Delivery of Disinfectants for the six months ending 31st March, 1917.

Printed Forms of Tender, Conditions of Contract, and full particulars may be obtained on application to the Borough Surveyor, Mr. W. R. Hicks, ASSOC.M.INST.C.E., at his Office, Town Hall, Ealing, W.

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Town Hall,
Ealing, W.
July 6, 1916. (2,040)

PERSONAL.

Mr. Norman D. Preston, surveyor to the Mayfield Rural District Council, who sustained a broken arm in an accident recently, is progressing satisfactorily.

Mr. F. P. Delamore, for many years assistant borough surveyor, was on Tuesday appointed borough surveyor of Bournemouth in succession to the late Mr. F. W. Lacey, at a salary of £550.

Mr. J. E. Edgcome, M.I.M.E., M.I.E.E., borough electrical engineer of Kingston-upon-Thames, has been re-elected hon. treasurer of the Incorporated Municipal Electrical Association for the tenth year in succession. Mr. Edgcome is a past-president of the association.

Mr. J. H. Drew, surveyor and waterworks engineer to the Wath-upon-Dearne Urban District Council, whose appointment as borough surveyor of Grantham was reported in this column last week, is not, we are given to understand, an associate of the Institute of Sanitary Engineers, having resigned membership some time ago. In addition to being a member of the Institution of Municipal and County Engineers and of the Royal Sanitary Institute, he is a member of the Institution of Civil Engineers of Ireland.

Mr. Cyril R. Brown, youngest son of Mr. J. A. Brown, of the *Isle of Man Times*, has received the appointment of assistant surveyor to the Mitcham, Surrey, Urban District Council. He served his articles with the borough surveyor of Douglas, and was afterwards appointed assistant surveyor to the Wombwell Urban District Council, where for two years he assisted in the carrying out of various public works. Mr. Cyril R. Brown has passed the examinations and is a student of the Surveyors' Institution, the Institute of Sanitary Engineers, and the Institution of Municipal and County Engineers, while he is also an associate member of the Institution of Municipal Engineers.

Mr. E. W. A. Carter, deputy city surveyor of Gloucester, has been appointed city surveyor and waterworks engineer, in succession to Mr. Richard Read, who resigned recently, after about forty years' service. The services of Mr. Read are to be retained as consulting city surveyor and waterworks engineer, at a salary of £250. Mr. Carter's salary will be £400 a year. The Mayor, in moving Mr. Carter's appointment at the recent meeting of the City Corporation, stated that the feeling of the committee which made the recommendation was that that gentleman possessed the confidence of the council to such an extent that any suggestion as to advertising the vacancy would not be entertained. Mr. Carter had been associated with the corporation for twenty-one years, so that the present occasion might be said to mark his coming of age; and the council had offered him a birthday present which they hoped he would accept. Mr. Carter, in accepting the appointment, said he loved his work, and that would be a sufficient incentive to him to do his best.

OBITUARY.

Mr. John Marshall, surveyor to the Malling (Kent) Rural District Council, died, we regret to state, last week at the age of forty seven. He had been in the service of the council about twenty-one years.

Buxton Incorporation. The Municipal Corporations (Buxton Scheme Confirmation) Bill, which has passed all its stages in the House of Lords, will now proceed to its stages in the House of Commons. The object of the measure is to confirm a scheme by which the urban districts of Buxton and Fairfield, Derbyshire, are granted a charter of incorporation, and will become the borough of Buxton.

The Gas Standard Bill.—The Gas (Standard of Calorific Power) Bill was read a second time in the House of Commons on Tuesday last. In explaining its provisions, Mr. Pretyman said it was a war measure, since its present object was to induce the gas undertakings to increase the production of benzol and toluol. During the war permission to vary the standard would only be given to companies prepared to erect plant for the purpose of producing these war necessities. But it was obviously quite out of date to insist on gas being gauged by its illuminating power, and to take permanent power to permit the change in the standard they were adopting the principle already approved by Parliament in private Bills promoted by gas companies.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Was it not rather an ingenious argument of a resident of Northallerton who had encroached on the public highway by enclosing a small piece of ground, that "every piece of waste ground should be made productive"? Were not the rural district council quite right in deciding "that the highway must be restored to its original condition," for is it not evident that a line must be drawn somewhere with regard to "fancy" lines for effecting economies?

* * * *

Have any steps yet been taken to discover whether the calorific value of house refuse would be increased by first passing it through a "lightning" crusher so as to disintegrate and thoroughly mix it before placing it in the furnace of a destructor? If the calorific value is increased thereby, would the extra expense and power required to effect the necessary pulverulence give such a result as would justify this preliminary treatment?

* * * *

"Is a motor-car a necessity for a surveyor?" is what the Mercantile Association of Newton Abbot, Devonshire, wanted to know in a letter addressed recently to the urban district council of that town. Could not one retaliate by asking if the Mercantile Association of Newton Abbot is a necessity?

* * * *

Was there not a very interesting article, entitled "Ideal Roads," in the *Standard* of the 17th ult.? Did it not give a very good account of Mr. Lovegrove's recent experiments with destructor clinker as a filler for a bituminous base and carpet as a road surface, and is not Mr. Lovegrove to be congratulated on the very excellent results he has obtained with this method of economical construction at an inclusive cost of only 3s. 3d. per square yard? Is it not also a hopeful sign for road engineers that the daily press should find room in their columns for news about road making?

* * * *

Is it not rather interesting to note that the New York State Highway Department cannot get labourers for work on their roads, although there is no war going on as with us? Does it not also point to the high cost of living in this part of the United States when we see that, although the wages are normally 7s. 6d. to 8s. 6d. per day for roadmen, and the Department is now offering more than this, they are still unable to get the men? Is it not a fact that the spending value of a shilling in the States is equal to about 6d., or less, in this country?

* * * *

Why is it that, as a rule, the verdicts in the Courts are usually given against local authorities unless they have a very strong defence against the actions which are so frequently brought against them? Is it because both Judge and jury consider that a public authority should be like Cæsar's wife—above suspicion? Is it because, as a rule, everybody's hand seems to be raised against a local authority, or is it because public bodies are supposed to have a very deep purse?

* * * *

How many of our Universities can follow the example of the California University at Berkley, California, and boast that upon their bookshelves they have, ready for reference, the whole set of bound volumes of The Surveyor since the commencement? Is it not a fact that in these volumes, with the help of the excellent indices in each volume, a student of municipal engineering can find much that will assist him in the study of this complicated and difficult branch of engineering?

Ayrshire Waterworks Extension.—The new rapid gravity filtration plant erected for the Irvine and District Water Board at Greenhead filtering station by the Paterson Engineering Company, Limited, London, to meet the growing needs of the towns of Irvine, Kilwinning, Stevenston, and Saltcoats, as well as Messrs. Nobel's works at Ardeer, was inaugurated last week. The various works recently constructed have cost £60,000, bringing the total capital expenditure to date to £275,000.

Obligatory Town Planning.*

By HENRY R. ALDRIDGE, Secretary National Housing and Town Planning Council.

A little reflection will show that the by-law powers of local authorities are quite inadequate to secure proper control over areas which are in course of development.

For example, in order to make clear how limited the powers possessed by local authorities really are—when town planning schemes are not prepared—the following definite points may be mentioned:

(1) Local authorities have no power to insist that only a certain proportion of a site shall be covered. All that they can insist upon is that each house shall have a certain curtilage space reserved for it at the rear. This space is usually 150 sq. ft.

(2) Local authorities have no power to regulate the height of buildings. An owner may build to any height he likes, provided that he does not interfere with the right of light of his neighbours.

(3) The defining of building lines in streets may be good or bad, just in so far as the ideas of the first owner who builds may be good or bad. Given the establishment of a bad building line by the owner who builds first in a street, the local authority is powerless to protect the amenity of the street.

(4) Except where the provision of cross streets is required under local Acts or by-laws, a local authority has no power to insist on cross streets, and a road may be made of great length without a break if the owners so desire. There is no power to restrict the building of long, unbroken rows of houses. In some cases as many as sixty to eighty houses have been built in monotonous lines without a single break in the line—each house the exact counterpart of the other.

(5) So long as the width of roadway and footway required under the by-laws is provided, local authorities have no power of control over the distance of the set-back of the houses from the footways, and have no power to require the provision of gardens and open spaces to serve as lungs for a district. The provision of open spaces is left to private generosity or is made the subject of heavy payments out of public funds when the land required has become desirable building land with an enhanced value.

(6) Local authorities have no power to prevent a house being built upon any spot the owner wishes, and may not even insist upon proper access being given to it. The site may be of such a marshy character as to render the maintenance of the proper health of the inhabitants of the houses when built almost impossible, but local authorities have no power to prevent this action being taken.

It is thus apparent that in areas for which town planning schemes are not prepared, landowners can lay out their land according to their own ideas, without giving real consideration to the development of land belonging to other owners and quite irrespective of the public convenience. Small builders, who up to now have erected most of the working-class houses, can develop as they like the plots of land they buy provided they observe the provisions of the by-laws. In but few cases, when land is sold, is any provision made for the class of houses to be erected, and a builder can, if he so desires, erect houses of the cheapest character among the best residential property, thus greatly depreciating it. Owing to the same lack of restrictive powers factories can be placed anywhere in a district, and a whole neighbourhood of good houses may be ruined by a factory being erected in their midst.

But there is no need to labour the point. The inadequacy of the by-law method is now admitted on all hands.

USAGE OF TOWN PLANNING POWERS.

It would seem at first sight that Parliament might well allow several more years to elapse before making the preparation of schemes obligatory on all local authorities.

In support of this argument it may be urged that many local authorities have recognised the enormous value of town planning powers and have adopted them willingly. But this argument must be rejected as invalid, since it does not take into account the almost incomprehensible apathy of most local authorities when they have placed in their hands duties of grave national importance.

The vital importance of this apathy and inertness of some local authorities will be made clear by stating a fact to which all must give assent—viz., that under the present permissive system the taking of action under the Act of 1909 bears no relation whatever to the need for such action. The factor is not one of need for action, but of the interest and zeal shown by individual councillors and officers. Where for any reason this factor of interest or zeal is absent, then no town planning action is taken, whatever may be the need for such action. Such a condition of affairs is not only absurd, it is against the public interest.

SKILL IN PLANNING.

Let it be clearly realised that in planning there are no mysteries. It is true that as in the practice of all arts, the difference between the work of the good artist and the bad artist may be very great. But provided that good standards are adopted and provided that wisdom is shown by officers and the local authorities they serve, the danger of bad planning is not very great.

In any case, the task of preparing the obligatory scheme described by Mr. Shawcross later in this report is one which need present no insuperable obstacles to any local authorities.

THE CASE OF RURAL DISTRICTS.

For no other reason than that of saving the country from a large waste of public money, it is essential that the desirability of rural planning should be regarded as within the range of practical politics.

There are no statistics available as to the width of the present main and secondary roads in rural districts, but it is probably a fact that, excluding the great main roads, three-fourths of the secondary roads which have to bear the bulk of the traffic of rural areas, and often serve to connect important towns, are less than 20 ft. in width.

Many public men are of opinion that there will be a great agricultural development in the near future, through the extension of small holdings and of co-operative undertakings, and in many districts much is hoped for from light railways and better and cheaper means of transit. New roads will be required—some of them main roads, the others to relieve traffic on present roads where the distances are too long between towns and villages.

It is estimated that the local authorities of Great Britain have had to pay an aggregate sum of £25,000,000 in the last fifty years as a result of the lack of foresight and power in regard to the proper planning of roads. There can be no doubt that a similar waste of public money will ensue if a great increase in the traffic of rural roads finds local authorities unprepared with proper schemes of development, and if no steps have been taken to secure proper building lines on existing country roads, so that all future buildings on such roads shall be set back at a sufficient distance from the centre of the road to allow future road widening to take place without the removal of costly buildings. It will also be difficult to fix the direction of new roads unless all authorities are compelled to make plans for their districts. A new road will often be required to pass from the area of one authority across that of another, and unless both co-operate in this it will be impossible to fix the position of such a road.

The need for the exercise of care in regard to housing development is equally important. It has been estimated that in order to meet the housing needs of rural districts in England and Wales from 100,000 to 120,000 new cottages are needed, and there can be no doubt that a period of cottage building in rural areas on a large scale is now beginning.

The experience of Ireland in regard to the building of cottages under the Irish Labourers Act is that, whereas at first the cottages were built near to the farms on which the men were employed, the cottages in recent years have been built in village groups. This will doubtless be the experience in this country,

* From a paper presented at the annual meeting of the Institution of Municipal and County Engineers held at Blackpool last week.

and here, as in Ireland, the need for care in grouping will be recognised. To build ugly streets of houses in long rows of an urban type will be to commit a blunder of the worst kind. It will, of course, be necessary to exercise great economy in road construction, but as land is cheap a good set-back can be provided, and an effort will be made to give a pleasing impression to those visiting the villages in which they are built.

In the case of housing schemes carried into effect by local authorities this can be done without any special town planning powers, but apart from the exercise of town planning powers, local authorities have no effective control of the lay-out of areas developed by private enterprise, and for this reason action in regard to planning will be found to be necessary. In such cases the term "town planning" is quite misleading, and some such term as "village planning" should be substituted.

In those villages in which there is no village green or playground it would seem to be highly desirable that as new houses are built, either by private enterprise or by public action, land should be secured for village playgrounds and open spaces. The giving of land for this purpose might well form part of a carefully prepared scheme of rural planning.

PROVISIONS WHICH SHOULD BE MADE OBLIGATORY IN PLANNING SCHEMES.

By H. SHAW CROSS, J.P., Chairman National Housing and Town Planning Council.

The nation will have to rely for planning schemes more on the engineer than on the architect. The planning of the roads will always be the most important practical part of a scheme, and this is essentially the work of the engineer.

But it must not be forgotten that the engineer is apt to look too much in planning roads to easy gradients and shortness of routes between different places. The architect, on the other hand, looks at road-making too much from the point of view of planning the roads in such directions that the accessibility of the different parts of the area for building and development are best secured. He is apt to sacrifice easy gradients and directness of route for the sake of getting the most pleasing effects in vistas and view points, and the danger is that these may be too much considered.

It would seem in the future that if the engineer prepares the plan and if the Local Government Board has a number of experts on their staff, these officials should be able to give the local engineer skilled advice upon his plan. Also the landlord's position in regard to the fixing of the lines for roads must not be overlooked. He will not agree to roads being put in such a position as to damage his land by making part inaccessible, and he may be trusted to look after his own interests.

The professional architect will come in when districts have to be developed and detailed plans prepared for the lay-out of residential districts. In what follows it is assumed that the desirability of making planning schemes obligatory on all authorities is admitted. In the first place it would seem desirable to make the obligatory provisions as few as possible and capable of being carried out in the simplest way. They should be designed to protect the area of the local authority even where no development is going on or is likely to happen in the near future, so that if for any reason, through the opening of a railway, and development of new enterprises (such as mining, or the discovery of minerals, or the presence of a good water supply attracting special works), a district came to be suddenly developed, the provisions of the plan would be there to prevent the overcrowding of people upon the land in the present unsatisfactory manner.

The provisions should also be designed to encourage, and not retard, the building of workmen's houses. Thus, if the small builder comes along wishing to build a few houses, he should be encouraged and allowed to do so without making too many demands upon him—only ensuring that each house has more space, light and air about it than has been insisted on hitherto by by-laws.

To effect this in every case certain points must be settled at once, and every authority would be required to frame provisions relating to these in their scheme.

The preparation of this obligatory scheme should not prevent more detailed and elaborate schemes being adopted later when towns begin to extend into different areas and when industries begin in country districts. It should then be the duty of the local authority to prepare schemes for the more detailed planning of those parts of their districts which are being developed. Such schemes would fix the residential areas, positions for shops, factories, &c., and reserve land for playgrounds, recreation grounds, &c.

It is clear that at the outset it will be necessary to define what is meant by making certain provisions obligatory. If legislation is passed to make it incumbent on all local authorities to prepare schemes within a certain period of time, it will be necessary to give power to the Local Government Board to issue regulations defining those matters which local authorities should be obliged to deal with in their schemes (except in the case of roads). In considering the provisions which should thus be made obligatory, it is of primary importance that the provisions shall be those which are not subject to claims for compensation under the existing Town Planning Act, for it is clear that local authorities will object to be forced to make provisions that would let them in for claims for compensation.

It is therefore suggested that in any fresh legislation that is passed to make it obligatory on all local authorities to prepare planning schemes, each local authority should be required to include provisions in its scheme relating to the following matters:—

(1) The fixing of building lines on all roads.
(2) The fixing of the directions of new roads.
(3) Limitation of buildings to the acre.
(4) Proportion of sites of dwelling-houses to be built upon.
(5) Space about factories, workshops and buildings of exceptional height.
(6) Provisions for varying the width of roads.
(7) Open spaces.
(8) Waiving of unnecessary regulations in building by-laws.
(9) Provisions to secure amenities and to prevent nuisances.

OBLIGATORY PLANNING IN RURAL AREAS.

It would seem that, so far as defining what provisions should be made obligatory in all planning schemes, it is equally necessary that the same matters should be dealt with in rural as in urban schemes.

The difference will be in the details of the scheme, especially in the number of houses to be allowed to the acre—which would be very much fewer in rural than in urban areas.

The question of sewerage and water supply will need to be closely considered in rural areas, for where there is no sewage system, and each house has to deal with its own sewage, ample space should be allowed round the house.

When, in addition, there is no water supply, but water is obtained from wells sunk in the ground for each house, the number of houses would require to be still further reduced to guard against the risk of contamination. If legislation is passed it will probably be necessary to make provision by which rural areas can alter their schemes when sewage systems are installed and public water supplies provided.

It must not, however, be forgotten that many rural districts have parts that are urban in character. What would appear to be wanted are clauses in a scheme by which provisions suitable to urban development can be applied to any part of a rural area by a resolution of the local authority, subject to the consent of landowners and others interested. Also it should be possible at any time to add to the details of a planning scheme without going through all the formalities required now in making a scheme. For instance, if a new road were required it should be sufficient if notices of intention to make same were posted in the district and advertised in the local papers, as is done now in the case of private improvement schemes.

It must also be remembered that, so far as roads are concerned, there is as much necessity for planning rural areas as urban. It would be somewhat farcical if on passing legislation to make planning obligatory it was only imposed on urban areas, for the effect would be that probably the greater number of houses built in rural districts would continue to have four-fifths of the site area of the house covered with buildings, and the same little back yard to each, as is now the case in urban districts.

INSTITUTION OF MUNICIPAL ENGINEERS.

VISIT TO WINDSOR WATERWORKS.

A visit was paid by the Institution of Municipal Engineers on Saturday last to the waterworks of the Windsor Corporation. Some sixty members and friends attended, and among the former were: Messrs. Henry C. Adams, M.INST.C.E., M.I.MECH.E., F.R.SAN.I., the president of the institution, E. A. Stickland, ASSOC. M.INST.C.E., past-president of the institution, and Horace Boot, M.I.E.E., M.I.MECH.E., past-president of the institution. Among the visitors were his Worship the Mayor of Windsor, Mr. W. Carter, J.P., Sir Frederick Dyson, ex-mayor, Alderman Bampfylde, ex-mayor, and Messrs. Walter Dodd, borough accountant, and C. A. Starkie, borough auditor of the Windsor Corporation. The majority of the members assembled at two o'clock on the riverside adjoining the London and South-Western Railway station, where a steam launch was in waiting, and proceeded to the waterworks on Tangier Island. Here the remainder of the party joined up, and the mayor, in a brief speech, welcomed the meeting to Windsor.

An inspection was then made of the pumping plant and of the filters, which latter were put into operation in September, 1915. The filter installation consists of six Candy Patent Declor pressure filters, each 8 ft. 3 in. internal diameter by 18 ft. high, constructed of mild-steel plates to withstand a working pressure of 100 lb. to the square inch. The filters have been laid down by the corporation in order to ensure that the water shall be as excellent bacteriologically as it is chemically and physically. The function of the Declor filters is to destroy any pathogenic bacteria that may accidentally obtain access to the wells, and so to safeguard the health of the borough in this particular direction. The destruction of the pathogenic bacteria is effected by the addition to the water, previous to passing through the filters, of a minute dose of a solution containing free chlorine, and it is estimated that with an ordinary good drinking water the addition of one part of free chlorine to 1,000,000 parts of water will ensure the destruction of the pathogenic bacteria responsible for water-borne disease. Although this exceeding small quantity of free chlorine is quite harmless to human beings, the Candy Declor filters are so constructed that it is eliminated after it has destroyed the objectionable bacteria.

As regards the pumping plant, this lifts the town's water by hydraulic, steam or electric power into the mains, after passing through the filters. A low-pressure turbine is placed in the 12-in. pipe leading to the filters, and is so constructed that its speed of rotation is proportionate to the volume of water passing at any given time. A small ram pump (in duplicate) is worked from a counter shaft driven by the turbine, and this pump is continually injecting into the water passing to the filters a solution of calcium hypochlorite, so that the water here receives its correct dose of free chlorine. The solution of calcium hypochlorite is contained in a small tank, and the ram pump draws direct from this solution tank, which also is in duplicate. After chlorination, the water flows along the filter supply main, and by branches is sub-divided and passes equally into the filters, each of which is arranged for dealing with anything up to a maximum of 8,000 gallons per hour. The installation is capable of treating over 1,000,000 gallons per twenty-four hours. The treated water enters the filters at the top, and, after passing slowly down through them, flows through branch pipes from the bottoms into an outlet main, and thence to the town supply.

All this was clearly explained by Mr. Stickland, who also showed the test for detecting whether the chlorination and dechlorination were being efficiently performed.

On leaving the waterworks, the party proceeded to Boulter's Lock, Maidenhead, where a short halt was called before the return journey. On arrival back at Windsor, before leaving the launch, Mr. Adams proposed, and Mr. Boot seconded, a vote of thanks to Mr and Mrs. Stickland for their hospitality and to the mayor and other members of the Windsor Corporation for the courtesy extended to the members in receiving them. The mayor and Mr. Stickland suitably responded and, finally, Sir Frederick Dyson proposed "The Ladies," to which Mr. E. Whitwell, borough surveyor of Abersychan, responded on behalf of Mrs. Stickland. The day's proceedings, for which Mr. and Mrs. Stickland were responsible, were carried out without a hitch.

COUNCIL MEETING.

At a meeting of the council held in London on June 28th, the following applicants were recommended for admission to membership: Messrs. Mortimer, R., town engineer, Roodeport Municipality; Hesketh, G. W., borough engineer, Estcourt, Natal; Gardner, J. C., consulting civil engineer, Niagara Falls; Ridout, W. W., municipal engineer, Nairobi, East Africa; Padmanabha, S., municipal engineer, Madura, Madras; Chand, Faqir, municipal engineer, Akyab, Burma; Cole, W. S. W., water engineer, Freetown, Sierra Leone; Ericson, R., lighting engineer, Perak State, Malay; Tyers, A. MacK., shire engineer, Bacchus Marsh, Victoria; Dolphin, Geo., surveyor, Uppingham and Gretton Rural District Councils; Pickering, Herbert, surveyor and engineer, Southam Rural District Council; and Nehra, R. K., engineer, Capt. Indian Army, Punjab. To associate-membership: Mr. Platt, F.S., East London Corporation.

Under the by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days. Elected to Studentship; Mr. Boardman, H. W., borough surveyor's Office, Douglas, Isle of Man. The following applicants, whose names had been duly published, were admitted to membership: Messrs. Griffiths, F. A., city engineer and surveyor, Ipswich, Queensland; Ramsay, Wm., city engineer, Fernie, B.C.; Patel, H. R., superintending engineer, Agra Municipal Waterworks; Bailey, H. S., municipal engineer, Benares; and Matwell, F. E. W., municipal engineer, West Kildonan, Man. To associate membership: Messrs. Gupta, P. C., Resident Engineer's Office, Metropolitan Water Board, Hampton; and Kellett, H., Surveyor's Office, Epsom Urban District Council.

MUTUAL AID DEFENCE FUND.

The draft, "Regulations for Administration of the Fund," as amended by the institution solicitors, were referred to the Special Committee for report.

The next meeting of the council will be held in London on Wednesday, July 26th.

ELECTRICITY CHARGES.

OBJECT OF SUMMER TIME ACT.

In the House of Commons on Monday, the President of the Board of Trade was asked whether, in view of the fact that the Government were appealing to everyone to economise during the war, and that one of the objects of the Summer Time Act was to assist them in doing so, he would introduce legislation limiting the charges of electric lighting companies and local authorities in proportion to the saving of expenditure which they were able to effect during the operation of this Act.

Mr. Harcourt, in reply, pointed out that the chief object of the Summer Time Act was to effect economy in the use of coal by public utility bodies. He was not prepared to introduce legislation in the direction suggested, as any reduction in the charges for electricity might encourage consumers to increase their consumption, and this would involve a corresponding increase in the use of coal by the supplying authorities. Further, the saving to the undertaking on the cost of the fuel economised was probably more than outweighed by the loss of revenue, owing to the reduction in the amount of current supplied.

Asked whether he was aware that the opinion was very generally held that the action of these electric lighting bodies was not only bad form, but very unpatriotic, and ought not to be encouraged by the Board of Trade, Mr. Harcourt said he did not think he ought to express an opinion upon that point.

Cistern and Sewer.—In the course of the Provincial Summer meeting of the Society of Medical Officers of Health, held on Saturday last at Hampton Court, Dr. F. J. Allan, medical officer of health for the City of Westminster and president of the society, mentioned that in a "Guide to London" of 1856, which he had purchased the other day, it was stated that the Thames was "both the cistern and the sewer of the Metropolis."

FUNDAMENTAL AND ECONOMIC CONSIDERATIONS IN RELATION TO TOWN PLANNING.*

By Wm. Ross Young,
Town Planning Engineer, Middle Ward of Lanarkshire.

The initial and perhaps most fatal blunder town planners are apt to make is the concentration of the greater part of their attention on those details and provisions which more properly fall to be considered at a later stage, with a corresponding neglect of those larger and wider issues on which further growth will hinge.

The science of town planning must primarily involve the study of the evolution of towns in relation to social progress and industrial activity, and reducing to some economic basis those governing forces which will determine their future growth, while the plans must be so conceived as to have sufficient elasticity to provide for their rational expansion, notwithstanding the nature, rapidity or direction of communal and economic impulses.

To be successful, town planners must be sufficiently broad in their views to conceive the possibility of new discoveries revolutionising the present industral system, and so changing the modern trend of communal life, just as the discovery of steam power did in the past. For, while the discovery of steam was the predominating factor in localising industries and centralising population, further discoveries and advancement in science may, it is hoped, cheapen power, transport, and travelling facilities to such an extent as to make possible the rapid decentralisation of large populations. In this connection ample provision should be made in the plans and provisions of schemes for the inevitable change to avoid the fatal error of unpreparedness for which so much has been suffered since the industrial evolution of the nineteenth century. Electricity and petrol make for a wider distribution of industries, and Letchworth is an example of possibilities in this direction.

It becomes more and more evident that the town planner's preliminary enquiries cannot rest with investigations concerned only with the growth of any particular or individual area, centre or unit, but must take into consideration its relationship to some main centre. The gradual merging of town groups must be foreseen and ample provision made in advance, and, while town planners must have in view the interposing of wide agricultural belts and open spaces in such a manner as will divide the ever-growing city-like regions into well-organised industrial and communal zones, more or less complete in themselves, the stage when the decentralisation of our industries as a whole lies within the sphere of practical economics has not yet been reached. There can be little doubt that the massing of population into defined centres is likely to continue. True, the density will be kept low and the city growth will be more spread over the land, but the garden city ideal by which the population is to be limited to a definite and preconceived number and where each garden city will be complete and self-supporting in itself, while highly practicable in virgin areas, will not, it is feared, take the place of natural city extension.

City extension directly depends for its creation and existence on the city activities around which it is growing; only in rare instances will it be possible to consider a populous centre or unit so completely isolated from others that its relationship to such need not be considered.

When the garden city movement spreads and new communities are designed so as to be complete and self-supporting, such as Letchworth, a new and entirely different set of factors are introduced; the problem of our city may then become less complex and the hope of regeneration more nearly at hand. The task, however, which town planners are confronted with at present is the laying down or formulation of schemes controlling and directing the lines along which the present cities are to expand and the manner in which whole towns are to be prevented from merging into huge, unhealthy and ill-organised city regions.

The study of city growth as a whole along these lines drives one to the conclusion that areas to be town planned must be sweeping and comprehensive; indeed, if proper results are to be looked for, schemes will often have to embrace the territory of several local authorities, each of which authorities, in the absence of town planning controlling bodies being set up for the larger and more clearly defined districts, will require to work in close harmony with each other and by conferences and otherwise do their best to reconcile their views.

No more fatal error can be made than rushing through sectional schemes unless their proper co-ordination with the many other schemes, which will have to be evolved before the city fringe is disposed of, has been assured and provided for. Any such system is not much better than the one which has hitherto obtained, where each owner made his estate the subject of an independent scheme.

After, and not until, the framework of a large and unified conception of the whole city fringe has been evolved can the sectional plans be started profitably and the consideration of those many details and features for which town planning schemes are to make provision can only rightly be begun.

* From a paper presented at the annual meeting of the Institution of Municipal and County Engineers held at Blackpool last week.

SCOTTISH SANITARY INSPECTORS' CONFERENCE.

PAPERS ON HOUSING AND WATER SUPPLY.

The Sanitary Inspectors' Association of Scotland held its annual conference at Perth recently, under the presidency of Mr. William Wait, chief sanitary inspector of Rutherglen.

Mr. Peter Fyfe, chief sanitary inspector of Glasgow, who gave an address on "The Housing of the Working Classes," advocated the use of concrete blocks for building. He gave the result of experiments as to the amount of carbonic acid gas in typical workmen's houses, and the average of foul air in these houses was 19·2 per 1,000 cub. ft. There was supposed to be a defect in the ventilation of factories where there was 10 in 12,000 cub. ft. In houses where people lived and slept the air ought to be at least as sweet as in a factory. He maintained that houses should be limited to three storeys, tenants should have the use of a bath and a larder for the keeping of perishable goods. It had been possible to build cottages of concrete blocks in England at from 2·8d. to 3·9d. per cub. ft. against a cost of 6d. in Glasgow for shops and houses dressed with cement.

Mr. William Asher, chief sanitary inspector of Perth, who dealt with "Water Supplies," referred to the difficulties encountered at Aberdeen. He suggested that a Central Governing Board should be established on a national basis to deal with vital municipal schemes. He thought the establishment of a Ministry of Public Health was not a Utopian proposal. It would be a bureau where authorities requiring a water supply could get all the chemical, bacteriological and geological information necessary without wasting years and thousands of pounds of money in the process of investigation, and at the same time it would be the body responsible for seeing, among other things, that each community had a sufficient and satisfactory supply for all purposes.

Keighley Trackless Trolley System.—With reference to the Keighley trackless trolley accounts, the report of the Tramways Committee states that, if only the average amount of frosty, hard, cold weather, which it was customary to expect in winter time, had been experienced, the nett financial result would have been very much more satisfactory. The total revenue had been £1,973, on a capital expenditure of £18,134. The amount provided and set aside for sinking fund had been £965, making a total of £1,429 in hand for this purpose. In a concluding general summary the manager observed that "it would appear that there is a prospect that the short distance existing between the Stockbridge terminus and the Bradford tramway terminus at Crossflats will be stepped over in the near future. Such a linking up with Bradford would, in my opinion, have a very beneficial effect on the Keighley tramway undertaking. The amount of goods traffic taken from Keighley to Bradford by road is developing every year, and it seems to be a legitimate field for the tramway undertaking to handle such traffic, and thus reduce the number of private vehicles of all descriptions, which would have a direct saving on the wear and tear of the roads." The Keighley Corporation's trackless trolley system, he went on to say, had been nearly completed during the year, and at the present time the last length was well under way towards completion. The whole of the overhead construction had been carried out at the contract price of £923 per route mile.

The Surveyor

And Municipal and County Engineer.

Vol. L. JULY 14, 1916. No. 1,278.

Minutes of Proceedings.

Obligatory Town Planning.

The paper on "Obligatory Town Planning," presented at the recent annual meeting of the Institution of Municipal and County Engineers by Messrs. Aldridge and Shawcross, was, as every one would expect from these well-known authorities, eminently practical, and though a warning was given by one speaker in the discussion that we ought to go slowly, the general feeling of the meeting was that town planning should be made obligatory. The case for obligatory town planning was presented by Mr. Aldridge, who said that before developing a town plan all the surveyors of the district should be brought together—such as in such a case as that of South Lancashire. From the beginning the surveyors of the local authorities should be consulted, and this was the view of the London authorities. Seven years only had elapsed since the Town Planning Act was passed, and now we were met with the demand to make it obligatory. The town plan should not be a congeries of by-laws streets, but have the widths of its roads and streets varied according to their requirements and importance. The power of local authorities under the by-laws is very limited. They cannot insist on more than a certain small proportion of a building site being left uncovered, and this is usually at the rear, and may be no more than 150 sq. ft. They have no power to regulate the height of buildings, beyond requiring additional strength for the walls as the building gets higher. The building line is fixed by the first builder in a street, and the local authority is powerless to prevent him building up to the footpath if the width of the street is sufficient to provide the open space required by the by-laws for the fronts of houses. No cross streets are required, and a terrace of seventy or eighty houses can be built without a break. No set-back of the house from the footway is required so as to provide a front garden or allow for future widening. The local authority cannot prevent a house being built in the middle of a field if the owner wishes, or compel him to provide proper access to the house. Again, a builder can build cottages, workshops or factories in a good-class residential neighbourhood, and neither the council nor the owners of the neighbouring property can prevent him ruining the district for residential purposes. While many local authorities have shown the greatest interest and energy in town planning, others are apathetic, and some unsympathetic. Mr. Aldridge rightly argues that such a condition of affairs is not only absurd, but against the public interest. Where amenity is most needed to make up for the drabness and hard toil of daily life there is the least care to provide it, while in the better-class residential districts we find they are invariably well catered for in this respect. Though Mr. Aldridge's remarks on Dowlais and the slums in the Scotland-road district in Liverpool called for the protests from Mr. Harpur and Alderman Muirhead, there can be no doubt that, much as these districts have been improved of late years, there is still great room for improvement on sanitary grounds, and especially in the provision of amenities.

The need for obligatory town planning in rural districts is, in Mr. Aldridge's opinion, quite within the range of practical politics. Three-fourths of the secondary roads which run through rural areas are less than 20 ft. wide, and many of these will be required to be widened to relieve the main roads, or for the agricultural development of the district. As it is estimated that a sum of £25,000,000 has been paid by the local authorities of this country as the result of their lack of foresight and power in the proper planning of roads, the necessity for giving rural authorities power to lay out roads on proper lines and of adequate widths is very evident. Mr. Shawcross is of opinion that provision should be made to protect the area of local authorities even where no development is going on, or is likely to happen in the near future. "It is always the unexpected that happens," and the introduction of a new railway, new industries, or the discovery of minerals may cause rapid and unexpected development. Prof. Abercrombie, in his paper, referred to Chester, where large industrial works just outside the city have led to overcrowding in the poorer parts of the city, while the growth of Doncaster and other coal districts is too well known to require further proof of this contention. The preparation of obligatory schemes should be required by the Local Government Board, but the obligatory provisions should be as simple and few as possible, leaving the more detailed and elaborate scheme to be prepared later. These provisions should not be subject to compensation, and no compensation should be given for improvements if they are such as are required by the by-laws. The obligatory provisions should include the fixing of building lines and the direction of new roads, the limitation of buildings per acre, the proportion of sites of dwelling-houses to be built upon, space about factories, workshops, and high buildings, varying the width of roads, open spaces, waiving of unnecessary building by-laws, and securing amenities and the prevention of nuisances. Mr. Shawcross suggests that all roads should have the buildings 60 ft. apart measured from opposite sides of the road, and that each building should be set back 10 ft. from the road; also that land for widening should be given by the land owners. The need for providing a greater proportion of open space on a building site is felt by all surveyors. In schemes already approved one-fourth to one-fifth of the site area of a dwelling-house is allowed to be covered with buildings, but under the by-laws the site of the usual workman's cottage has barely one-fifth of its area unbuilt upon. While there is very little in the

paper with which surveyors will disagree, they will find in it much that is useful and that will call for careful consideration.

* * *

Transport Reform.

Although the correspondence which has appeared in our columns during the past few weeks shows that there is some difference of opinion concerning the merits or practicability of Mr. Gattie's scheme of transport reform, it further shows that the matter is one which has an undoubted interest for municipal engineers. This being so, Mr. Gattie had an excellent opportunity at the recent Blackpool meeting of the Institution of Municipal and County Engineers of explaining the engineering details of his proposed railway clearing-house to an audience of engineers, all of whom are practically interested in problems of transport. Although his lecture was listened to with interest and appreciation, it must be confessed that he did not succeed in making the best use of the opportunity presented to him. It would probably have been better if he had laid less emphasis upon the political aspect of the matter and had confined himself to a description of the engineering details of the scheme. Our readers must by now be familiar with the nature of the proposed reform, which consists in the introduction of goods clearing-houses in all large centres throughout the country. These clearing-houses would be so designed and equipped with such machinery as to facilitate the automatic sorting of goods arriving to them. The initial cost would, of course, be colossal, but so it appears would be the annual saving upon revenue. The figures as stated by Mr. Gattie are truly astonishing. For example, he states that by the adoption of the clearing-house system, terminal work which now accounts for more than 90 per cent of the total cost of railway transport could be carried out in 1 per cent of the time and on 1 per cent of the space now occupied in doing this work. Further gigantic economies would necessarily result in rolling stock, labour, and many other directions. Indeed, it may be said that not only would the whole nation have the advantage which it does not at present possess of quick, cheap, and safe goods transport, but that at the same time the railway companies would earn larger profits for their shareholders, and be able to pay better wages to their employees. That the present system of goods transport is essentially uneconomical is beyond controversy. Broadly speaking, it may be said that a railway goods wagon is in active use for but 3 per cent of its life, the remaining 97 per cent being wasted in detention. Similarly, with regard to locomotives 75 per cent of their energies are consumed in shunting operations. The advantages claimed for the clearing-house are that by an enormous reduction in the time taken in loading and unloading trucks by the container system these trucks would be in active use for a correspondingly larger proportion of their total life, and that by the virtual abolition of shunting the useful life of the locomotive would be similarly increased, and that the risks to life and limb attending this dangerous operation would be eliminated.

Mr. Gattie has apparently had considerable difficulty in interesting the Board of Trade and the railway companies in the success of his scheme. He states that in June, 1914, the German Government, on learning of the idea through the daily Press, at once got into touch with him through the Consul-General in London, while a visit was subsequently paid to the model works by a representative of the Ministry of Transport of Berlin. Whatever opinion any individual may hold as to the merits of the reform proposed, it cannot surely be contended that the idea having been put forward by a man of Mr. Gattie's experience is not at least worth the most serious consideration. It is to be hoped that some at least of the members of the institution will take advantage of the invitation to pay a visit to the works at Battersea and to see for themselves a demonstration of the clearing-house in operation. The thanks of the institution are due to Mr. Gattie for having gone to Blackpool to deliver his interesting lecture.

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London of the Future.

At a recent meeting held under the auspices of that very useful body the London Society, Mr. Arthur Crow delivered a lecture on "The Port of London—Past, Present and Future," in which he discussed the provision to be made on the rather startling assumption that in the year 1975 the population of the Metropolis will have reached the colossal figure of twenty millions. Before the lecturer unfolded his vision of the future, Lord Devonport, who, as chairman of the Port of London Authority, most appropriately presided over the meeting, spoke of the present position of the Port and the work that has been accomplished in connection with the war. He pointed out that when the present dock improvements are completed there will be no less than four miles of new quayage. Moreover, the war has increased the warehousing business of the Port by some 50 per cent. Hundreds of transports have been fitted and loaded; eight hundred million pounds of oats have been transferred from cargo boats and put into bags; two million gallons of rum have been drawn from the vats into jars for use by the troops; while the Port of London has also bulked and packed all the tea consumed by the new armies during their training, and lent their splendid wreck-raising plant for many a ship which has been mined or torpedoed, and which would otherwise have been totally lost.

In looking to the future of the Port, Mr. Crow was strongly of opinion that if the evils of the past are not to be repeated, it is essential that ample and far-sighted provision should be made at once in the matter of arterial roads. Inasmuch, too, as the free and rapid transit of merchandise from docks to manufactory and from manufactory to railway and back again to the docks is a matter of primary importance in regard to our commercial supremacy, the allocation of specific areas for manufacturing premises in close proximity to these main lines of communication is also desirable wherever possible. Indeed, it may be said that the commercial future of the Metropolis depends to no small degree upon the wisdom with which the traffic problem is faced. With an adequate system of arterial roads of sufficient width to allow of the separation of fast and slow traffic, and the provision of space for light railways or electric cars running either singly or connected, there is no reason why much of the warehouse and factory work may not be transferred from the central area into the open country. If this desirable end is to be achieved, however, a well-considered scheme is necessary, and it should provide for ample and unrestricted means of intercommunication between the docks, railways and manufactories, rapid means of transit between the central area and the docks, both for passengers and goods, as well as easy transit between the industrial housing areas and the docks and manufacturing areas. In short, as far as the provision of arterial roads is concerned, the town planning of Greater London must be dealt with as a single problem, although the filling in of the details may well be left to the several local authorities concerned. We entirely agree with Mr. Crow that the present problem of the growing congestion in the central areas is one of serious and immediate concern, and remedial measures must be regarded in the light of Imperial needs.

Public Abattoirs.

Most municipal engineers will agree with the statement made by Mr. H. A. Brown, the engineer and surveyor to the Weston-super-Mare Urban District Council, at the beginning of the paper which he read at Blackpool, that there is probably no branch of municipal work which has a greater influence upon public health and which has hitherto received less attention than the construction of abattoir buildings. Some years ago, as a result of a strong agitation in favour of slaughter-house reform, a Government Commission of Enquiry was appointed. This commission made every possible investigation, consulted all the authorities, and visited a number of abattoirs, both in this country and on the Continent. As a result of their enquiries the commission came to the conclusion that a good deal of cruelty was going on, and that this could be prevented by greater attention being given to the design of the buildings and much suffering obviated by the adoption of improved methods of slaughter. Their report, which was presented in 1904, recommended the adoption of certain principles which are now considered elementary. In the first place, all animals awaiting slaughter should be kept apart from the actual slaughtering, so that they can neither see nor smell what is going on. Again, no animal should be slaughtered until all traces of a former victim have been thoroughly washed away. The broad principle upon which a modern abattoir should be designed so as to comply with these essential conditions is that the buildings should be so arranged that the animals can enter at one end, go through the several processes, and ultimately pass out at the other end without traversing the same block twice or crossing an open roadway.

The matter of abattoir design is certainly one in which this country has been far behind other countries on the Continent of Europe. The reason for this may be that which Mr. Brown suggested —namely, that in England the subject of slaughter-houses is so distasteful to the majority of people that its consideration is shelved to the last possible moment, when it is dealt with in a hurried manner, the slaughter-house being considered as an evil which has to be tolerated. Abroad, on the other hand, the subject is approached from the humanitarian and hygienic standpoints as a definite problem of public health administration. The result is that in many continental towns the abattoir is placed in attractive surroundings, with shrubs, trees, and grass plots introduced wherever possible, all walls being glazed internally, and a complete and elaborate system of meat inspection being established. Mr. Brown's experience in regard to this matter at Weston-super-Mare, together with visits which he has paid to other institutions, enable him to speak with authority on a question the importance of which is certainly far greater than would be supposed from the small amount of attention that it receives.

* * *

Reconstruction in Dublin.

The harm done by the recent unfortunate events in Dublin was not limited to the material damage caused by the actual destruction of property, and a further effect is now being felt in the difficulty of re-establishing trade connections that have been severed. It is true that considerable progress has already been made in clearing the devastated area of wreckage and *débris*, but it is impossible to keep business suspended until a permanent scheme of reconstruction is carried out. In most cases, therefore, temporary premises are being provided in order to facilitate the resumption of business. We gather from a recent issue of our contemporary the *Freeman's Journal* that, as might be expected, there is no desire on the part of the city authorities or of anybody else to delay matters by a single day, and no hindrance whatever is placed in the way of the erection of such emergency structures as tradespeople may deem suited to the exigencies of the moment. Several of these are in process of erection or in contemplation, and it will be a considerable time before permanent premises are generally well advanced. So far it appears that only two firms have lodged complete plans for their new establishments and have started work on that basis. It is surmised that some few others of the more prominent traders affected will follow on the same lines, but for the great majority the wooden structure will have to suffice for the present. In the words of a prominent city official who has to do with the designs, the earlier restoration of the ruined area will be very much like the first start of a pioneer city of the prairie. It is the intention of the corporation to deal with the general question of reconstruction by means of a Bill, and active steps are already being taken towards its preparation. It is interesting to observe that one of its provisions proposes to give the corporation a regulating power over the designs, and an effort will also be made to get controlling powers with regard to the widening of narrow thoroughfares in so far as they were affected by the destruction. As matters stand at present the corporation has really no effective control of the designs. They cannot unreasonably or vexatiously withhold their approval of plans of buildings submitted to them, and in the case of the rebuilding of a ruined street they have no authority in the way of providing for a wider thoroughfare.

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National Health in War Time.

Mr. Walter Long, in reviewing the work of the Local Government Board on Tuesday, was able to present quite a satisfactory and favourable, if not a roseate, impression of the hygiene of the country during the past year. There have been many delicate and difficult problems to handle in that period without there being much time to spare for deliberate consideration with respect to details, yet the public health has been maintained at a high standard. Although for a period of two years there have been enormous numbers of men suddenly collected in certain areas, where there was often at first insufficient accommodation, there has been a steady decrease of enteric fever, while "there was no probability of any danger from smallpox." This latter statement argues a high note of official confidence—much too high some might consider—but if, as is probably the case, it has reference to the provision made for the isolation and treatment of possible patients, it reflects satisfactorily the activities of the local authorities in regard to hospital accommodation. The circumstances under which these conditions have been maintained ought not to be overlooked by the public any more than they will be forgotten by the responsible officials, who in conditions of great responsibility have contrived to "carry on" the sanitary work of the nation. The future, as Mr. Long indicates, has much in store for us. There will be need for the immediate consideration and prompt action with respect to housing, public works, and further health provisions. These subjects have been more or less—rather more than less—in a state of suspended animation for some time past owing to financial exigencies, but, according to the statement of the President of the Local Government Board, they are being carefully surveyed by the Reconstruction Committee. Mr. Long was obviously justified in dealing with departmental problems in a spirit of optimism, and it may be added that he did not fail to acknowledge with gratitude the enormous amount of voluntary work that has been so nobly pressed into the service of "mitigating existing evils and anticipating future needs."

My Experience with Fine-Grade Filters.*

By W. H. MAKEPEACE, M.R.SAN.I., Sewage Engineer to the County Borough of Stoke-on-Trent.

There has been, at one time or another, considerable controversy as to the life of a fine-grade filter. In 1912 I brought to the notice of the Association of Managers of Sewage Disposal Works the limits of this type of bed, and, as a further four years have passed, I felt it would be of sufficient interest to record my experiences.

The Royal Commission, in their final report respecting this type of bed, had to fall back on that all-important word "if" in the conclusions they arrived at.

Practically the whole of the 17 acres of filters under my control at present are of the fine-grade type, the upper layers varying in size from $\frac{1}{16}$ in. to $\frac{1}{8}$ in., $\frac{1}{4}$ in. to $\frac{1}{8}$ in., $\frac{3}{16}$ in. to $\frac{3}{8}$ in., and $\frac{3}{8}$ in. to $\frac{5}{8}$ in., the depth in all cases being 12 in. Underneath this is a layer of $\frac{1}{2}$-in. to $\frac{5}{8}$-in. cubes, which form the main body of the filter, and this is supported by $\frac{3}{4}$-in. to $1\frac{1}{4}$-in. cubes as the lower layer of filter media. This in turn is supported on 12 in. of 2-in. cubes overlying the under drains, the average depth being 5 ft.

The rate of distribution per square yard per day at the Hanley and Fenton works is 200 gallons, the upper layer in this case being $\frac{1}{4}$ in. to $\frac{1}{8}$ in. and $\frac{3}{8}$ in. to $\frac{3}{16}$ in. respectively. At the Tunstall and Burslem works the rate is about 175 gallons, with an upper layer of $\frac{3}{8}$ in. to $\frac{5}{8}$ in. and $\frac{3}{16}$ in. to $\frac{3}{8}$ in. respectively. At Longton the rate is 130 gallons, the upper layer in this case being $\frac{1}{8}$ in. to $\frac{1}{16}$ in.

With the exception of Burslem, the tank effluents from the five works maintain a steady figure of 11 to 12 parts per 100,000, about half of this being mineral solids. At Burslem the solids in suspension figure in the tank effluent averages about 15 parts per 100,000.

The method of distribution at Hanley, Fenton and Longton is by means of rectangular power-driven distributors, which are arranged to distribute the sewage on to the beds with an interval of rest of about six minutes. At Burslem and Tunstall the distributors were of the power-driven rotary type, which I have recently converted to automatic rotaries. It is generally admitted that this method of distribution is very good at the former three works, and at Burslem and Tunstall it is also satisfactory.

After twelve years' continuous running of the beds at Hanley works it has not been necessary to renew or wash any portion of the area, and the effluent to-day still remains a good one. No choking has occurred, and the matters in suspension discharged on to the beds does, contrary to expectations, come away regularly and freely with the effluent. For the first seven years there was practically no suspended matter in the filter effluent. At the eighth year it rose to 1·92, with a greater discharge immediately after a bed had been restarted from the resting period. The solid in suspension figure to-day is about 2·5, and this I attribute very largely to the imperfect tank effluent, brought about chiefly by the efforts made to work the plant in the cheapest manner possible.

RECOVERY OF BEDS AFTER REST.

It is very surprising to find how rapidly a bed recovers after a short period of rest. I generally find that after a bed has taken rest, and by raking over the upper layer of the filter, which contains the bulk of the matters remaining on the bed, it has been perfectly free, and will keep on working for a considerable period without signs of surface pooling. I find that the surface pooling does not have any material effect on the effluent, unless it is allowed to go on indefinitely.

A great improvement has been effected in the effluent at the Burslem works, owing to the proper grading of the material and provision of under drains, with, of course, a greatly improved tank effluent. The suspended matter has also come away quite freely, and causes us no difficulty as far as choking of the filter is concerned.

At Longton, where we have the very fine material at the surface, the rate of distribution has had to be reduced to 130 gallons per day, and at this rate considerable pooling takes place after a month or six weeks' continuous working. The size used here as a top layer is, from my experience, too fine, because of the great difficulty of obtaining a material which at this size is hard enough, and which would not easily disintegrate. The effluent, however, here is by far the best in the department, practically no suspended solids passing with the effluent from the bed, with the result that the surface soon becomes waterlogged and a rest is necessary.

A good deal of this difficulty has been overcome by forking into the filtering material a larger size, and to a great extent we have obtained satisfactory results.

For practical use I am satisfied that the material on the Longton beds is too small, because it will not allow any great variation in the rate per yard treated. The most useful size is $\frac{1}{4}$ in. to $\frac{3}{8}$ in. as a top layer, which I have placed on two beds at the Burslem works. These readily take a volume equal to the rate of 200 gallons per square yard per day, and the effluent is a very good one, and the matters in suspension come away very freely from the bed.

When the various works in this department were designed no provisions were made for humus tanks, as at that time it was not thought necessary. I have, however, put down humus tanks at Tunstall with a capacity equal to $2\frac{1}{2}$ hours' flow. This takes practically the whole of the matters in suspension, and the effluent discharged from the tanks is very clear.

LIFE OF FINE-GRADE FILTERS.

Although the Royal Commission in their recommendations consider the life of a fine-grade filter to be about five years, I find that after thirteen years' working it has not been necessary to renew or wash any of the filtering material. In one or two cases, however, the time has arrived when this would be an advantage to the discharging power of the bed, principally at the Longton and Hanley works. The effluent, however, has always been of an exceptionally good character, and, as we are on the banks of very small streams, this is an important matter to us.

One of the chief things to aim at in the successful working of a fine-grade filter is perfect distribution of the sewage. This type of filter will, however, stand a more varied rate of flow than a coarse-grained filter, and maintains the quality of the effluent. This, in my judgment, is due to the rapid splitting up of the sewage discharged on to the bed through the greater number of interstices and smaller area than is the case in a coarse-grained bed. With this type of bed you are able to deal with any trouble arising, as, owing to its size, it is nearly always found on the upper layer, where it can be more readily controlled and, if necessary, removed.

I need hardly remind the members of this association that the most important thing, in order to obtain the greatest efficiency from this type of bed, is to see that the tank effluent is as perfect as possible. In our case this has been readily obtained by simple sedimentation in rectangular tanks, and immediately we find our matters in suspension increasing beyond 12 parts per 100,000, steps are taken to clean out same.

The material used in the filters in the Potteries is called "saggers," a waste product from the pot works which has been fired very hard. It was thought years ago that this would disintegrate very rapidly, but very little disintegration has taken place, and, in view of the size of this material, it has stood the test exceptionally well.

Fine-grade filters work better when the sewage is distributed on to them at intervals, and I find that an interval from three to six minutes gives the most satisfactory results over a continuous and lengthy period. I should prefer to put down fine-grade filters at any place in preference to coarse filters, if it is reasonably possible to obtain a good tank effluent, because the purification is likely to be more thorough; but time has proved that this type of bed will stand much more abuse and last a longer period than was anticipated some years ago.

I certainly am of opinion that, under proper control, fine-grade filters will not become permanently choked; will readily discharge humus after two or three years' working, and will after that period come away regularly, and the character of the humus will lend itself to precipitation as readily, and will be in a more inert condition than the humus from a coarse-grained filter. It is very important, however, to have complete aëration, and the under-drainage of the filter must be as complete as possible.

* Paper read at the Annual Summer Conference of the Association of Managers of Sewage Disposal Works held at Sheffield last Saturday.

The Sewage Problem.

LATEST DEVELOPMENTS AND POSSIBILITIES OF THE FUTURE.*

By Dr. SIDNEY BARWISE, B.SC., County Medical Officer of Health, Derbyshire.

We English are a slow thinking people. It has taken this terrible war, in which everything which makes life worth living is at stake, to drive into our stupid heads the obvious truth that national security should come before the pursuit of wealth. So it took the epidemic of cholera in 1831 to bring home to our people the necessity for providing themselves with a proper system of sewers. In 1843 a Royal Commission on sanitary conditions of towns led to the passing of the Towns Improvement Clauses Act of 1847, and the Public Health Act of 1848, under which a general board of health as a central authority obtained power to set up local boards of health. I am old enough to remember seeing the water-carts going along streets in a suburb of Birmingham bearing the title "Local Board of Health." The designation was a good one, but the principle under which they were appointed was Gilbertian, for it was the districts in which sanitation was neglected which could set up these local boards—not the progressive districts, but the districts with a death rate higher than 23 per 1,000.

As the result of the Sanitary Commission sitting from 1869 to 1871, the Local Government Board was set up, and the Public Health Act, the sheet-anchor of sanitary administration of this country, was passed by Lord Beaconsfield in 1875.

As far as the question of sewage disposal is concerned, the first commission was appointed in 1857, and they reported in 1865. The commission was called into existence as the result of the sewering of towns carried out as preventive work against cholera under the Acts of Parliament already mentioned. In 1868 another commission was appointed, which made several reports, the last being 1874. Up to this time the treatment of sewage consisted of three processes—chemical precipitation, broad irrigation, and intermittent land filtration. The commission reported that all these processes might be relied upon to remove matters in suspension, but that the best results were obtained by intermittent filtration.

Another commission was appointed in 1882 to report on the system under which the sewage of London was discharged into the Thames, and what measures should be applied for remedying any nuisance if such was found. In 1884 they reported that evils did exist which demanded prompt remedy, and that by chemical precipitation the liquid might be sufficiently free from noxious matters to be discharged at the present outfalls, but not permanently.

The Local Government Board have made it their practice to be bound by the findings of the various commissions. In practice it has had an unfortunate result. As far as the purification of sewage is concerned it is not any advantage to an authority to produce a good effluent—it is the local authorities lower down the stream who obtain the benefit of a good effluent or who suffer inconvenience if the effluent is bad; so that until the Local Government Act of 1888 was passed, bringing rivers boards and county councils into existence, local authorities had not the incentive of "self-interest" to produce the best effluents, and in consequence carried out the schemes which cost least.

FAILURES.

The system of throwing sewage disposal schemes open to competition has resulted in a certain type of engineer studying the paper requirements of the Local Government Board, based on the recommendations of various Royal Commissions, so as to put a scheme before the local authority with the sole object of obtaining the sanction of the Local Government Board to it. The result was that twenty-five years ago, it is no exaggeration to say, nine-tenths of the sewage schemes in the country were failures. Broad irrigation schemes had been adopted where the land was quite unsuitable, and, worse than this, stiff clay land was sanctioned for intermittent filtration, provided it was lightened by engine ashes.

I was appointed to take charge of the public health department of the County of Derbyshire in 1891. At that time the only method of sewage disposal in the county, except at Long Eaton and Buxton, was by land irrigation. In the two places mentioned there were precipitation schemes, and, needless to say, the effluents were unsatisfactory. As most of the land in the county is stiff clay, as a first step I advocated tank treatment and precipitation in addition to broad irrigation, and works on these lines were carried out at Alfreton, Chesterfield, Ilkeston, Heanor, Chapel-en-le-Frith, New Mills, and Burton-on-Trent. The result, although a great improvement, was not altogether satisfactory.

In the early 'nineties schemes of precipitation and artificial filtration through filters composed of materials the size of peas, covered with a layer of sand, were adopted, and gave good results, but required constant attention. I refer to what was known at the time as the International Sewage Company's process. These schemes proved that sewage could be purified without large areas of land.

About the same time Mr. Dibdin elaborated his contact-bed process, and an acre of experimental contact bed was put down. Following on this, Mr. Cameron, of Exeter, called attention to the part played by bacteria splitting up organic matter in what he called a septic tank. The greatest credit is due to him for his imaginative touch in calling a tank a "septic tank," because it riveted attention on the function of bacteria in the purification of sewage.

In 1897 I prepared a *résumé* of principles involved in the purification of sewage, in which I laid down that, as far as Derbyshire was concerned—

(1) The land would purify by broad irrigation the sewage of from 25 to 100 persons to the acre.

(2) If precipitation was also adopted it would purify the sewage of some 200 to 400 persons to the acre.

(3) That on limited areas of suitable soil the sewage of some 500 to 600 persons to the acre could be purified provided the sewage underwent preliminary chemical precipitation.

(4) That the sewage of some 2,000 persons could be purified by chemical precipitation and subsequent filtration through specially prepared filters of coal, coke, polarite, burnt ballast, &c.

I then stated what was subsequently found by the Royal Commission—that an artificial process was advisable, except where sandy or fine, gravelly land could be obtained at about £100 per acre.

The first sewage filters were covered with sand, which was a constant source of trouble.

The next step forward was the elimination of this layer of sand, the sewage being sprayed over the filters through fixed perforated pipes. To get a sufficient spray over the surface of the filter a considerable head was required. To make the application of the tank effluent intermittent, various mechanical devices were adopted—tippers, automatic valves actuated by floats, and automatic syphons. Continuous drip filters were also brought out, such as Stoddart's and Colonel Duckett's.

In the same year (1898) the Royal Commission on Sewage Disposal was appointed, and in 1901 they issued an interim report in which it was admitted that it was practicable by artificial processes to produce stable effluents which might be discharged into any stream. The point I wish to make is that local authorities were in advance of the central authorities.

Following on the interim report of the Royal Commission, the question which first excited public attention was the relative advantages of percolating filters and contact beds. In the same year as the Royal Commission's interim report I published a small work on the bacterial purification of sewage, in which I summarised the relative advantages and disadvantages of filters and contact beds, and summed up in favour of filters. The main advantage of contact beds was that no distributor was necessary. I pointed out that to obtain good results from filters the material must be quite free from dust, and the particles should be from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. in size. In the same report I pointed out the advantage of revolving arms over fixed distributors. In Derbyshire we have not found it necessary to adopt any patented revolving arms.

Since the final report of the Royal Commission was

* Presidential address delivered at the Annual Summer Conference of the Association of Managers of Sewage Disposal Works held at Sheffield on Saturday last.

published a most striking development has taken place in the nitrification of sewage without filters.

One of the fixed ideas that everyone had who has touched the problem of sewage purification is that Sir Edward Frankland had proved that sewage could not be purified by direct aëration; that no river in England was long enough to purify the sewage that flowed into it; and hundreds of men must have experimented on sewage by blowing air through it. It remained for Dr. Fowler and Messrs. Ardern and Lockett, and at Salford, Mr. Melling, and Messrs. Martin and Duckworth on a practical scale to prove that sewage could be nitrified by activated sludge and aëration. The part played by bacteria and infusoria was never dreamed of at the time Sir Edward Frankland made his experiments. There may be many changes, such as physical, chemical and electrical, taking place to-day which we do not appreciate, and we must guard against taking an unscientific and dogmatic attitude.

The practicability depends upon the cost. On this account, where there is sufficient fall for the oxidising process to take place on artificial filters without pumping, the activated sludge process, involving as it does practically the cost of pumping, is out of court.

When pumping is necessary, whether the activated sludge process will become a practical proposition or not depends upon the ability of the engineer to get over mechanical difficulties.

The first Salford experiments never professed to be a final exposition on this point, but a demonstration that sewage could be pumped by aëration by means of activated sludge, both in fill and draw tanks. In these experiments the air is blown in through nozzles, and it is obvious that the great bulk of the air blown through the sludge and sewage is not used up. To get over this difficulty Messrs. Jones and Attwood brought out their diffusers of cast-iron boxes with porous tile covers. These diffusers have this advantage over nozzles, that the air is blown out in the form of small bubbles.

There are two desiderata required for the process:—

(1) Aëration.

(2) Continuous mixing so as to bring the whole of the sewage into intimate contact with the activated sludge.

I think that agitating the sewage could be done more economically by mechanical mixers than by blowing in air, especially if tanks without corners were designed specially for this purpose.

With regard to the aëration, it should be borne in mind that the work is done by the oxygen which is dissolved, and when saturated, the amount taken up is only 7 parts per 1,000 by volume. There can be no doubt that the amount of air being pumped in is in excess of what is required for aëration.

THE SHEFFIELD EXPERIMENTS.

Since coming to this conclusion I have had an opportunity of seeing the suggested experiments made by Mr. Haworth, the chemist in charge of the Sheffield works. Mr. Haworth is agitating his sewage by a mechanical agitator and blowing air into the sewage by an extremely efficient form of screw, consisting of three screw propellers driven off one shaft, and has found that to saturate the sewage with oxygen, it is only necessary to use this aërator for two minutes every half-hour.

When you have seen Mr. Haworth's experimental installation, I am sure you will agree with me that the Sheffield investigation opens up a new field of thought and, like all that comes from Sheffield, goes a long way towards making the new process a business proposition.

A miscroscopic examination of the activated sludge shows it to be teeming not only with bacteria, but also with infusorial life. These bacteria and infusoria are not "anchored" as they are in percolating filters and contact beds.

This leads to special difficulties. The sludge containing the organisms which do the work sometimes floats, sometimes settles. The conditions under which it does one or the other will have to be discovered and special arrangements will have to be devised to prevent the sludge washing over. Again, when manufacturing wastes are discharged which are inimical to the organisms, the process of purification will stop abruptly. In times of heavy storms there will be a risk of the organisms being washed out of the tanks. It appears to me that the future use of this new process will be in combination with existing processes of purification, but that it is not fair to judge the new process by experiments on existing plants. Works to carry out this process should be specially designed. The tanks in which the activated sludge is working should have no corners, should probably be circular, and the whole of the sewage should be kept on the move by some mechanical process, and the tanks should be used continuously night and day. The separation of the sludge should take place in a specially designed tank with a sloping bottom at a high pitch, and the clarified fluid should be removed through floating arms. Again, in the tank where the aëration takes place, I think it is quite worth while considering the advisability of having suspended shallow filters of coke, a foot deep, on the top of the tank through which the air would bubble continuously and which might be drawn out of the tank in a cage for aëration.

RESEARCH WORK.

In conclusion, I want to call public attention to the necessity for the practical research work which is being done by members of our association being linked up with the work done in our universities. If we are to succeed as a nation, the linking up of practical affairs with our higher educational establishments must be much more close in the future than it has been in the past. There are many problems in connection with the purification of sewage which are obviously matters for university research. The engineering students in the university of Sheffield should all have the opportunity of sitting at the feet of such men as Mr. Haworth. It is only by getting in touch with the practical working of schemes such as that of the city of Sheffield that the problems which have to be solved can ever come to the knowledge of the professors of chemistry, electricity, biology, of the university. Much bigger grants from the State are required to enable these investigations to be made. The progress which Germany has made commercially is largely due to the State subsidising university professors who have worked for the benefit of German manufacturers.

We owe the activated sludge process to the fact that the university of Manchester was coupled up to the practical working of the Manchester sewage purification scheme, and that Dr. Fowler was working for the corporation and for the university. This is as it should be, and if we are to succeed this kind of connection must be multiplied in future all along the line.

Contractors' Claim for £97,000.—After twenty-eight days' hearing, the action of Messrs. Spencer, Santo & Co., Limited, contractors, against H.M. Office of Works was settled on Tuesday. The plaintiffs claimed £97,000 balance alleged to be due by the defendants in connection with the cost of the building of the new Local Government Board offices in Whitehall. The defendants agreed to pay £3,000, each of the parties to pay their own costs.

Canals and Waterways.—In reply to a question in the House of Commons on Monday as to whether any steps had been taken to consider the advisability of making preparations for carrying out any part of the recommendations of the Royal Commission on Canals and Waterways as a matter of national benefit and with a view to mitigating labour difficulties which were likely to arise on demobilisation, Mr. Harcourt stated that the recommendations in question would be borne in mind in considering the problems that would arise.

Revenue from Refuse.—The British De-Tinning Company, 75 New-street, Birmingham, are arranging for a meeting of representatives of local authorities to be held in London for the purpose of explaining their scheme for enabling those bodies to utilise waste metals—such as are found in town refuse—which have hitherto been exported to Germany and Austria. Among the public bodies which have already made a working agreement with the company is the Southwark Borough Council. The company has agreed to erect a building and plant at the Manor-place depot, at a cost of £3,000. When finished this is to be handed over in working order to the council, who in consideration are to pay the company 50 per cent of the additional profits made by its use. There is one hard-and-fast stipulation, and that is that the profits on the undertaking shall not be less than what the council was already obtaining by the sale of its waste tins, &c. The council are taking practically no risk, as the company are finding customers for the metal produced, which is to be paid for at pre-war rates, and any profits will be equally divided.

Public Abattoirs: A Comparison of British and Continental Practice.*

By H. A. BROWN, Engineer and Surveyor to the Weston-super-Mare Urban District Council.

As might be expected from the origin of the word, France was actually the first European country to establish public abattoirs on anything like satisfactory lines, and the fine buildings at La Villette—erected nearly fifty years ago—are still in advance of those of many Continental towns. Germany has developed the modern slaughter-house system in a wonderful manner, and her abattoirs to-day are, as a whole, the finest in Europe, but Switzerland and Holland in certain instances are not far behind; indeed, for practical purposes, and considering the restrictive legislation which hampers local authorities in this country, the fine abattoirs at Edinburgh will compare favourably with some of the Continental ones, and although the writer cannot speak from personal experience, he understands that the old slaughter-houses at Belfast have now been transformed into a most complete range of buildings for this work. It is, however, unpleasant to remember that, notwithstanding the enormous strides made in this country in sanitary science in recent years, the fact remains that in the twentieth century, while Paris has two of the finest municipal abattoirs in the world and no private slaughter-houses, London has nearly 300 private ones, and not a single municipal abattoir. The buildings at Islington and at Deptford are not taken into account; the former are hopelessly out of date, and the latter are used only for the killing of imported cattle. We have nothing to compare—except the two previously mentioned—with the Continental abattoirs, either in design, organisation or general arrangements, and the cause of this is not far to seek. In England the subject of slaughter-houses is so distasteful to the majority of people that the consideration of it is shelved until it becomes pressing, then it is dealt with in a hurried manner, as an evil which must be tolerated, while abroad it is approached both from the humanitarian and hygienic standpoints, and those engaged in this class of work are regarded as persons who are discharging the most valuable public duties. Indeed, the social status of an abattoir superintendent on the Continent is not lower than that of the average professional man.

The most practical illustration that can be given of the difference between the two systems is to compare the plans shown on Figs. 1 and 2. The former is that of a typical English abattoir for a town of 60,000 persons, erected at a cost of £7,000, while the latter represents a Continental abattoir erected at a cost of £18,000 for a town of 20,000 population. In this country the prevailing idea seems to have been to crowd as much as possible on to a small and often unsuitable site; the general arrangements being made quite regardless of any consideration for the animals. One writer on the subject says: "It is hard to realise that a country like ours, with such a complete sanitary system, public baths, &c., can tolerate for a moment the utterly puerile erections that have been thrown up from time to time and dignified by the name of 'Public Abattoir.' After having visited nearly all the public abattoirs of note in England, the writer can only state that the average English abattoir is a disgrace to our national intelligence, and that a worse set of buildings could hardly be designed."

These are strong statements, on which the author has no comment to make, but suggests that every engineer to whom this question is referred should visit the Continental abattoirs before preparing his plans. He will find palatial buildings in attractive surroundings, with shrubs, trees and grass plots introduced wherever possible, every wall in the place glazed internally, marble slabbed lairages, slaughter-halls wherein the animals are treated in a most humane manner, and a complete and elaborate system of meat inspection. In England it is supposed that such expenditure is wasteful, but such a supposition is hardly tenable in view of the fact that, notwithstanding the enormous capital expenditure, there is not a single public abattoir in Germany which is not self-supporting. While in England a prolonged and costly legal battle has to be entered upon in order to make any advance, however slight, in these matters, in other countries any public authority is empowered under the existing law to close private slaughter-houses, and erect new public abattoirs whenever they choose to do so, making such charges as are sufficient to maintain the buildings, pay the interest and sinking fund on the capital, and redeem any sums payable to the butcher by way of compensation in those cases where private slaughter-houses have been compulsorily closed. In some towns 8 per cent is allowed as the maximum to cover capital charges, and curiously enough the authorities are further empowered, if they so decide, to continue this charge, even after the loan has been redeemed. It is noteworthy that the period of repayment is longer than is customary in this country, and the following percentages from the balance sheet of one large Continental abattoir will be of interest:—

Depreciation on buildings	3·00
Machinery	13·00
Fittings and appliances	10·00
Lighting, &c.	15·00
Cold storage	15·00

This distribution of some of the profits was made to absorb the surplus funds, and the figures do not include

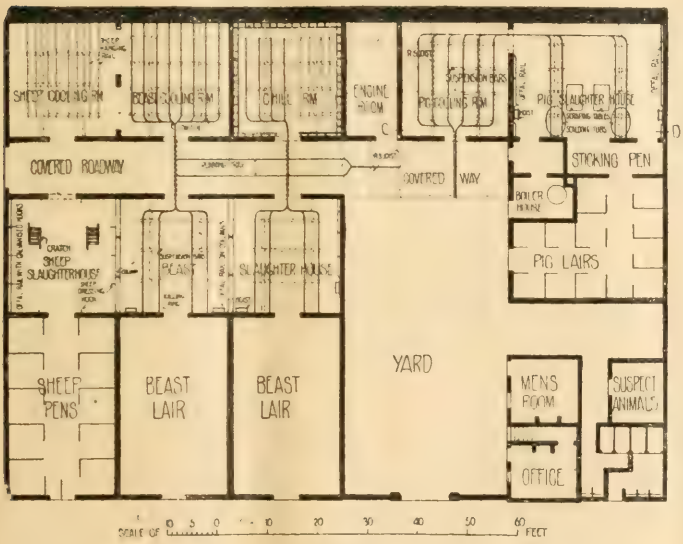

FIG. 1.—BRITISH ABATTOIR.

* From a paper presented at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

any repayment in respect of the loan. A point of interest to be noted is that the same or heavier charges are levied in the case of imported meat as in respect of animals killed in the abattoirs, so that no revenue is lost to the town by the butchers purchasing foreign meat. The following table may be taken as illustrative of the charges in force in some towns in Germany for slaughter dues :—

	s. d.	s. d.
Beasts	4 6 to 6	6
Pigs	2 6	
Calves	1 1	
Sheep	0 6	

And, in addition, special charges may be levied for veterinary inspection. The following are the charges in vogue in Weston-super-Mare and are representative of the average charges in this country :—

	s. d.
Beasts	1 0
Pigs	0 6
Calves	0 6
Sheep	0 3

It is also worthy of note that our Continental neighbours have solved the question of compensation for the closing of private slaughter-houses by increasing the charges for the use of the abattoir in proportion to the amount actually paid, with the result that very few of the claims have been admitted, and in the majority of cases have been ultimately withdrawn. This points to the advisability of securing Parliamentary powers before proceeding with schemes of this nature. Another point to which attention should be called is that in most cases on the Continent a charge is made for inspection of these abattoirs, but, what is more important, nothing is wasted, all the by-products, even to the sewage, being treated in some form or other, for the extraction of everything of value, an example which might be followed in this country with advantage. Practically similar arrangements may be seen in Switzerland and Holland, and in these countries, and so thoroughly has the question been dealt with that no one is permitted to trade as a butcher unless he has served his apprenticeship, and possesses a certificate of good health and competency.

BASIS OF DESIGNS.

A glance at Fig. 2 will show how complete are the arrangements for the various processes, and the excellent way in which the blocks are planned in relation to each other, all separated, either by open or covered passages. Provision is made for horse slaughtering, and there is a cold store and ice-making plant, the latter no doubt being a profitable undertaking. The one thing missing which is found in most abattoirs in Germany, is a bar or beer hall. These canteens are provided in many places, and result in considerable profit to the town authorities, and in a few instances there are also restaurants. The area of ground covered by the buildings in this case is about 4½ acres. The fault of the Continental system appears to be that a similar design is considered applicable to every conceivable set of conditions. For example, if one enquires the basis upon which the dimensions of the various buildings are calculated, one is referred to a table which sets out that for every person x sq. ft. must be allowed, and this appears to be strictly adhered to, the result being that in towns of fluctuating populations money is needlessly wasted if the maximum population be allowed for, and the premises are inadequate if the minimum or average is taken.

It is admitted that the broad principle upon which modern abattoirs should be designed is that the animals enter the buildings at one end and go through the various stages, ultimately passing out at the other end without having to go through the same block twice, or across an open roadway, and there are other conditions which appear to be important. The site should clearly be easy of access for the persons using the abattoirs; it should adjoin both the railway and the cattle market, so as to facilitate the delivery of cattle and to avoid the danger and annoyance caused by their being driven through the streets.

If noxious trades such as gut-cleaning and boiling are to be carried on in the abattoirs (which certainly should be the case) some consideration will have to be given to the prevailing winds so as to avoid a nuisance in the town, and it is undoubtedly an advantage to plan the buildings in the direction of the outfall so that the sewage does not have to pass through the town sewers, particularly if blood is allowed to enter.

[Mr. Brown's paper included some particulars of the recently opened abattoirs at Weston-super-Mare, but these buildings having been fully described in our issue of January 28th last, it is unnecessary to reproduce the matter.]

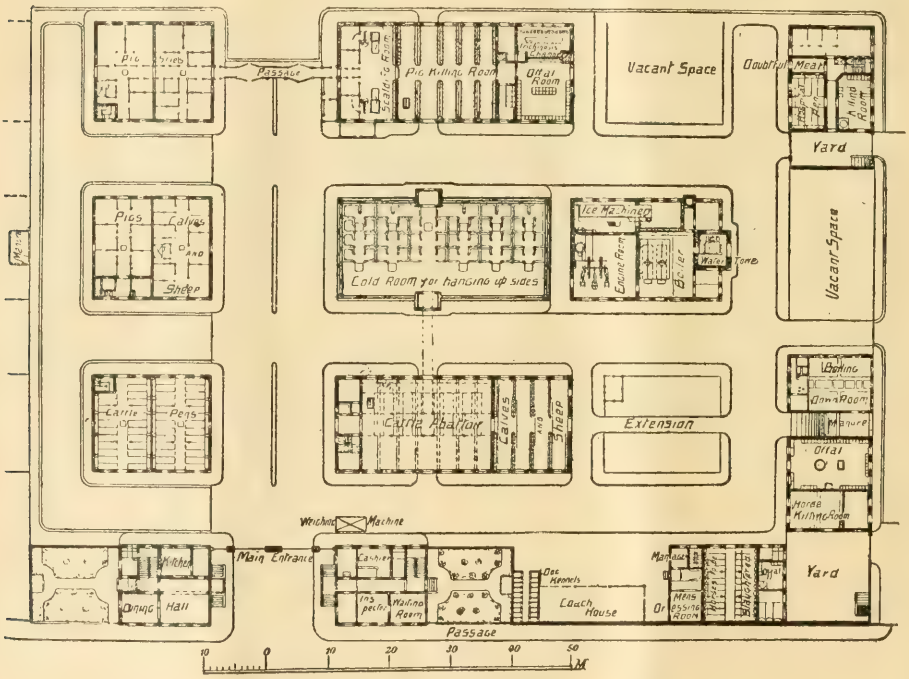

Fig. 2.—German Abattoir.

Association of Managers of Sewage Disposal Works.

ANNUAL SUMMER CONFERENCE AT SHEFFIELD.

The annual summer conference of the Association of Managers of Sewage Disposal Works took place at Sheffield on Saturday last. The proceedings, which included the delivery of the customary presidential address, reading of papers and visits to works, opened at the town hall, where the members were accorded a hearty welcome to the city by the Lord Mayor (Mr. F. A. Warlow). The attendance at the meeting included Dr. Sidney Barwise (Derby County Council), president, Aldermen S. Osborn (Sheffield), W. E. Rothwell (Bury), G. Lawrence and R. W. James (West Kent Sewerage Board); Councillors G. Clark (Chesterfield), C. W. Rothwell (Ashton-under-Lyne), J. A. Noston (Manchester); Messrs. C. F. Wike (Sheffield), A. B. Coomber and A. Scott Murray (West Kent Sewerage Board), R. Giles (Burton), G. Barford (Maidenhead), R. Otter (Leicester), H. Lumb (Todmorden), Alfred Stone (Bulcote), Charles H. Ball (Manchester), W. Tomlinson (Chesterfield), Charles Griffiths (Heywood), H. Edwards (Manchester), G. Fowler (Brighouse), Z. Degg (Stamford), H. E. Partridge (Stourbridge), C. M. King (Barnsley), A. Degg (Standford), A. Booth (Batley), C. Adkin (Worsboro' Dale), R. W. Adkin (Worsboro' Dale), J. Bolton (Bury), J. W. Gaskell (Honley), J. Taylor (Sutton), D. Robertson (Garforth), W. Cann (Fenton), Henry Burrows (Doncaster), John Priest (Bath), Norman Hall (Retford), Robert Lee (Ramsbottom), William Pattinson (Milnsbridge), J. H. Garner (Huddersfield), W. D. Scouller (Chester), W. J. Ashley (Oldbury), R. Tyson (Queensbury), J. W. Hartley (Stoke-on-Trent), J. Clifford (Nuneaton), J. Sheldrake (Ossett), Frank Naylor (Denby Dale), R. Higginbottom (Thurnscoe), A. V. Reynolds (Longton), George Alty (Ramsbottom), H. G. Foule (Sheffield), H. Oliver (Rotherham), A. Booth (Batley), J. Jones (Oldbury), Thomas Barlow (Denton), B. Butterworth (Crompton), O. Wilkinson (Manchester), James Bogden (Crompton), Frederick Hambleton (Newcastle, Staffs), W. J. Hadfield (Sheffield), W. L. Angell (Sheffield), William Jackson (Rivers Board, Sheffield), Charles E. Wood (Chesterfield), R. Frazer (Chesterfield), E. Sutcliffe Law (Haslingden), H. W. Stafford (Dukinfield), A. Applewhite (Lincoln), J. H. Kershaw (Rotherham), W. H. Makepeace (Stoke-on-Trent), John Haworth (Sheffield) and J. B. Croll (Richmond Main Drainage Works), secretary. Letters of regret for non-attendance were received from Messrs. Baldwin Latham, past-president, Percy Williams, W. H. Duckworth, P. Gilmartin and J. H. Abbott.

The LORD MAYOR, in his address of welcome, observed that Sheffield had spent during the past few years approximately £350,000 on sewage disposal works. The corporation now had in hand a scheme of further extension, which had received the approval of the Local Government Board, but, owing to the war, had been dropped. The question of trade wastes was one which he thought ought to receive the special attention of the association. If they could dispose of those wastes on modern and scientific lines without causing any disadvantage in other directions, they would confer a considerable benefit on the whole community.

Dr. Sidney Barwise, county medical officer of health, Derbyshire, afterwards delivered his presidential address reproduced on another page, a vote of thanks being accorded to him on the proposition of Mr. J. H. Barford (Maidenhead), seconded by Mr. R. Giles (Burton-on-Trent). As managers of sewage works, said Mr. Barford, they would feel very encouraged by what had fallen from Dr. Barwise. Several of Dr. Barwise's predecessors in the chair had been medical officers of health, and, looking at the interests of the association, he was bound to say that was about the best source from which they could derive their presidents.

"My Experience with Fine Grade Filters" was the title of a paper presented by Mr. W. H. Makepeace, ASSOC.M.INST.C.E., borough sewage engineer of Stoke-on-Trent. The contribution is reproduced elsewhere in this issue.

Mr. J. BOLTON (Bury), in moving a vote of thanks to the author, said the figures which Mr. Makepeace gave were a revelation when they recalled how in the earlier days they were given to understand the amount of suspended matter put on a fine-grain bed would rapidly choke up the filter.

The vote of thanks was seconded by Mr. A. V. REYNOLDS (Longton), and carried.

ACTIVATED SLUDGE EXPERIMENTS AT SHEFFIELD.

Mr. JOHN HAWORTH, F.C.S., manager and chemist of the Sheffield Sewage Disposal Department, followed with a paper describing the city sewage disposal works and experimental works. This paper also will be found on another page.

Mr. C. H. BALL (Manchester), in moving a vote of thanks to Mr. Haworth, said there could be no doubt that the question of activated sludge was one which overshadowed every other form of sewage treatment at the present time. He was uncertain how many years ago it was since Mr. Haworth had been conducting his experiments; he had gone on regardless of failures, and, so far as he could see, had gone on until at the present moment he was leading in this subject. Manchester, of course, had been closely associated with the question, and at both the Davyhulme and the Withington works they were increasing the experimental plant. The question was in its infancy, and while it could be taken up by all and sundry, it could not but go forward. To those who had not tried the method he would seriously recommend it. The position of Manchester as regarded trade wastes was, unfortunately, somewhat similar to that of Sheffield. He had to contend with a considerable quantity of acid wastes, which had a marked effect on the bacteria in the activated sludge, and it was a question which they would have seriously to consider as to how these occasional heavy doses of acid waste were to be met. Mr. Haworth, he noticed, had a considerable discharge, and one of the results had been that the tank went out of action for several weeks. That was very serious, because they could not have sewage works going out of action. In regard to the distribution of air, there were many methods being tried at present. The porous tile was one. In Manchester they had made several experiments. For instance, they had used an open pipe, the air from which came up in large bubbles. That, however, meant an excess of air, and they were anxious that the minimum amount of air should be used. The experiments which they had conducted had shown them that one of the tiles which gave the best results was the "Filtros," an American product, though this was rather expensive. They had also experienced the trouble of cracked tiles. When that occurred the whole of the air at the point affected was discharged, the sludge became stagnant, and the process went out of action at that particular spot until the tile was replaced.

Mr. J. H. KERSHAW (Rotherham), in seconding the vote of thanks, said that after what would be seen on the visit to the works in the afternoon he thought it would be agreed that the activated sludge process was not going to be worked by any system of porous tiles or air compressors. The question of the effect of trade wastes on this new process was, of course, very important, for, as had been said, they could not afford to stop a tank for weeks. As a result of experiments with a sewage containing gas liquor refuse, he had found that sulphur cyanide could be eliminated by this air-blowing process, though, of course, it could not be done on a big scale.

Mr. W. H. MAKEPEACE (Stoke-on-Trent) said he had always maintained that the solution of the sewage problem would come from a direction such as this. He had an opportunity some years ago of seeing the Manchester experiments being conducted on these lines, but felt from his observations at the time that the most formidable obstacle in the way of the development of the experiments was the amount of air required. After reading the paper it had occurred to him that in his cylindrical arrangement Mr. Haworth had a possible means of economising the air. The only point that had occurred to him was how long it took to agitate the sewage and to bring about the results he had recorded. The success of this proposition depended, of course, very much on that. With the object of reducing the enormous

consumption of air he had been conducting experiments with three or four vessels, the surplus air from the first of which was conveyed in turn to the others. The results he obtained were quite satisfactory, and the amount of air required to bring about the purification was dependent entirely on the number of vessels used.

The vote of thanks was passed.

Mr. Haworth, in replying to the points raised, stated that the actual experiments in aëration commenced some four or five years ago, when they were dealing with the question of some form of secondary treatment. The position at Manchester as regarded trade wastes was evidently the same as at Sheffield. He had known samples of sewage at a given time contain as much as 2 parts per 100,000 of free sulphuric acid—that was where the wastes were discharged in the vicinity of the sewage works. It was one of the problems in connection with the process. At Sheffield there had been a considerable amount of fungoid growth inside the porous tiles, and the fact that there had been no such trouble at Manchester showed the desirability of each sewage being treated on its merits. With regard to the question of the selling of the sludge as manure, he was always suspicious when fortunes were spoken of in connection with that. As a matter of fact there was considerable prejudice against the use of sewage manures; farmers he had met had a great objection to it and there was also the sentimental objection of the public. The question had been asked how long it took to get the effluents of which he had given particulars. For some time he worked the tank—in which there was no blowing—by filling it once a day. He had filled it more often, and he found at the present time that he could get an effluent with an oxygen absorption of, say, 1·5 per 100,000 in from two to three hours. It was his intention to work one of the experiments to destruction—to increase the load until the treatment ceased. Concluding his remarks, Mr. Haworth said he was anxious that the development of the activated sludge process should be taken up on a sound basis. They knew how often sewage managers' difficulties were increased by having works hastily put down before a process was properly thought out. He did not want that to happen with this process.

MIDDLESEX ROADS.

COUNTY ENGINEER AND ECONOMICAL MAINTENANCE.

The condition of the main and subsidised roads maintained by the urban and rural district councils in the county of Middlesex is dealt with in the eighteenth annual report of the county engineer, Mr. H. T. Wakelam, M.Inst.C.E., F.G.S.

"With the continuance of the war," says Mr. Wakelam, "and the consequent withdrawal of further labour from the roads, adverse maintenance conditions are now being experienced in the county to a far greater extent than during 1914-15, and the question of providing even passable surfaces, especially on some of the macadamised roads carrying heavy traffic, is becoming an increasingly difficult problem. Owing to the unavoidable difficulties an informal conference with the engineers and surveyors of the different local authorities was held, with a view to endeavouring to frame some sort of procedure under which the best and most economical measures could be employed.

"At the conference, which took place at the end of 1915, I impressed upon the various engineers and surveyors present the need for keeping the various roads to at least a standard of repair by carrying out as much 'patching' work as possible; and at the same time I asked them to economise as much as possible in the direction of scavenging and watering, with a due regard to sanitary requirements from a health point of view. The point was emphasised that it was not sound economy to allow any given road to get into such a state of disrepair as would necessitate a large expenditure upon it at the end of the war, and this was, I think, fully appreciated by all present. Since the conference the question of economical maintenance has resolved itself into a serious problem. At present, owing to the requirements of the War Office, and other factors, it is difficult to carry on road works of any kind. Labour, transport, and supplies of materials are extremely limited and uncertain, and in my judgment it will only be by the tar-painting work, now being carried out on the surfaces of many macadamised roads, that these will be made sufficient for the summer months. During the forthcoming winter a deterioration is to take place.

STORAGE OF MATERIAL.

"I call attention to this point, so that all the highway authorities of the county may take time by the forelock, and store as much material as possible during the intervening months and before bad weather sets in. Further, wood blocks, asphalt, asphaltic materials, &c., have advanced so much in price that should supplies of metalling, of a basaltic or granite nature, become more difficult to obtain, it will be almost an impossibility to go to the expense of permanent surfacings. It will therefore be recognised how difficult it will become to carry on road works under such conditions, unless provision is made in advance, and it is only fair to ask that the indulgence of the public may be extended to the county council, and also to the other authorities, should any of the main roads drift into a state which may appear to be unworthy of a great county like Middlesex.

WORK AFTER THE WAR.

"The reinstatements of roads at the end of the war, which I have already mentioned, will no doubt furnish employment for large numbers of men. In addition to the arrears of work in connection with water-bound roads, there are several miles of wood-paved carriageways in the county which will probably have to be renewed. Should the Road Board be amalgamated with the Local Government Board it will be well, when the time arrives, for applications to be submitted to the Local Government Board for grants towards the anticipated reconstructions which will have been chiefly caused through the character of the traffic the roads of the county have been carrying during the greater part of the last two years. In connection with the total estimated cost, £17,515, of tar-painting work on the main light railway and subsidised roads of the county during the ensuing year, an application for a grant has been submitted to the Road Board."

The various reports in detail follow, attention being called in several cases to the necessity for repairs alongside the tramway margins. In a comparative statement, printed as an appendix to the county engineer's report, the total cost per mile of maintenance and loan repayments, in respect of main roads maintained by the county council, is given for the past three years. The difference is shown to be very considerable in some cases—*e.g.*, Bath-road, 1913-14, £623 17s. per mile, 1914-15, £951 10s.; Kingston and Staines road, £459 8s. 8d. and £550 13s. 2d.; Bushy Park, £517 10s. 3d. and £587 10s. 11d.; Staines-road, £866 17s. 6d. and £993 8s. 11d.

Hull's Petrol Substitute.—The recent report that Mr. F. W. Bricknell, the city engineer of Hull, had made a contract for six months with a local firm of producers for the supply of a petrol substitute at 1s. 6d. per gallon proves to be inaccurate. The corporation, we are informed by Mr. Bricknell, are buying what is equivalent to "Taxibus" at "Taxibus" price.

Leeds Sewage Works.—In the course of the annual inspection of the Leeds sewage undertaking at Knostrop, recently, Alderman Oldrod gave some details of the Knostrop scheme. The total cost, he said, would be £1,277,000. Of this sum, £207,000 was for new main sewers. Since 1908 the committee had expended on land and works £477,639. There were current contracts entered into and remaining incomplete to the value of £375,000, and of these they had carried out work to the value of £172,000. The cost of operating the sewage works last year was £13,681 as compared with £12,134 the year before; the difference was accounted for by rates and taxes, coal, and increased wages and war allowances. The working cost of treating 1,000,000 gallons of sewage last year was £2 10s. 7d., an increase of 8s. 4d. as compared with the previous year. Last year they pumped a daily average of 15,000,000 gallons of sewage, out of which was extracted no less than 36,000 tons of pressed sludge cake. Of this, 5,000 tons was sold to farmers as manure, and 31,000 had been tipped on to the low-lying lands of the estate, at a cost of about 9d. per ton. They had been trying to find means of making the sludge cake more saleable, and when the war broke out they were on the point of experimenting with machinery to render the cake into powder, in which form they might be able to get farmers to use it more extensively.

ALEXANDRA BRIDGE, PIETERMARITZBURG.

THE CANTILEVER PRINCIPLE IN REINFORCED CONSTRUCTION.

About three years ago the Pietermaritzburg Municipal Council decided to replace an old wooden bridge, which for thirty-five years had carried the main road over the Umsindusi River from the city proper to the suburbs of Scott-ville, Alexandra-road and Pentrich. Preliminary designs were prepared for the new bridge to determine whether it would be advisable to use steel or reinforced concrete in the new structure.

After careful consideration, the council decided in favour of the reinforced concrete bridge, because it was shown that in comparison with a steel bridge the former was less costly to construct and maintain, that it had a longer effective life, and would prove more elegant in appearance. Mr. James Just Niven, M.INST.C.E., the borough engineer of Pietermaritzburg, who was primarily responsible for the design, consulted with the Trussed Concrete Steel Company, Limited, and engaged them to prepare the detail drawings for the reinforced concrete work on the Kahn system of reinforcement.

ALEXANDRA BRIDGE, PIETERMARITZBURG, NATAL.

The new bridge was opened to traffic about the middle of last year, and has fulfilled all expectations in regard to the method of construction adopted. It is a graceful structure, in a beautiful setting of green foliage, with the Umsindusi River flowing underneath at a depth of 40 ft. below the level of the roadway.

The bridge comprises two symmetrical cantilevers, each resting on a pier of mass concrete built on the

solid rock bed of the river. The principles of the design of this bridge are similar to those employed in the design of the famous cantilever bridge over the Firth of Forth, and this is probably the first occasion on which such principles, hitherto used only in structural steel bridges, have been adopted in the case of a reinforced concrete bridge.

In this instance the cantilever members are curved, thus giving the appearance of an arched bridge with a central span of 75 ft., flanked at either end by a half arch of 38 ft. span. The entire weight of the bridge, and of any uniformly distributed live load upon it, as well as any combination of loads balanced about a supporting pier, are carried by the cantilevers, and are transmitted as vertical loads to the two piers.

The centre span, consisting of the two half cantilevers abutting each other, is also designed as an arch to provide for any unequal loading upon it. Any unbalanced load on the two end spans is carried by the half-arch cantilevers acting as beams supported at one end on the main pier and at the other end by the light abutments constructed at the extreme ends of the bridge. This arrangement has produced a design which is not only economical in the use of materials, but which requires very light end abutments, because the maximum load they will be called upon to carry at any time will be only that due to inequality of loading without the weight of any portion of the main structure.

The bridge is 170 ft. long and 30 ft. wide between the parapets, having two footpaths each 5 ft. wide and a roadway 20 ft. wide. The two outside arches are 20 ft. apart with the 5-ft. footpaths cantilevered from the decking of the roadway. This adds to the pleasing appearance of the bridge.

The bridge was designed to carry a maximum load of two 12-ton traction engines, each hauling a train of six trucks loaded to 6 tons each, with an additional distributed live load of 100 lb. per super. ft. Immediately after its completion and before it was opened to traffic, the bridge was tested by running a 15-ton steam roller over it. The maximum deflection recorded was about one-twentieth part of an inch, or one-eighteen-hundredth part of the span. Upon the removal of the load the bridge assumed its normal condition.

The total cost of the bridge was £5,625, which included the cost of the demolition of the old structure, the erection of temporary bridges and other works, the formation of the macadam roadway, the footpaths, the electric lighting, &c. Whilst the bridge was being erected the opportunity was taken of raising its height some feet above the level of the old bridge, so as to improve the gradients of the approach roadways and to raise it above the flood level of the river. The cost of the embankments, inclusive of reinforced concrete fencing, extension and alteration of the storm-water drains, the electric light cables, the water-mains, &c., was £3,817. These figures represent the actual cost of the work as paid to the contractor. If the usual 5 per cent be added for designs and supervision these amounts would be approximately £5,906 for the bridge and £4,008 for the approaches. Assuming the effective life of this construction as 100 years, and maintenance expenditure during that period at an average of half per cent per annum, the cost works out at £90 annually.

As previously mentioned, Mr. James Just Niven, M.Inst.C.E., was responsible for the general design of the structure and adopted the Kahn system of reinforced concrete after giving due consideration to this form of construction. The contractors were Messrs. Peattie & Stannard, of Pietermaritzburg, who carried out the work under the supervision of the resident engineer, Mr. W. C. Thornely, in succession to the Late Mr. J. D. Keith, Assoc. M.Inst.C.E.

Road Tarring and Fish Life.—The question of river pollution and the disastrous results upon fish from the use of crude tar upon roads was raised at the annual meeting of the Salmon and Trout Association, held on Tuesday at Fishmongers' Hall, London. A suggestion by Lord Desborough that a Bill might be promoted in Parliament enabling an individual to take action against anyone who used crude tar for road making or mending met with approval, and, on the motion of his lordship, it was agreed that the matter should be referred to the Experimental Committee, with powers to instruct counsel to draft a Bill to lay before Parliament. Lord Desborough mentioned that he would be prepared to introduce such a Bill into the House of Lords.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

MUD AS A BUILDING MATERIAL FOR COTTAGES, &c.

To the Editor of The Surveyor.

Sir,—I am interested in the subject of mud as a building material, and no doubt there is a future before it. As an English nation we are very slow in moving out of our usual groove, which is often detrimental in many ways to our advancement. Surely if it is possible to cheapen the erection of cottages or other buildings by the introduction of mud as building material we should endeavour to use it!

The general objection to its use at present seems to be its unsuitability to our climate, but this may be overcome. It has already been suggested and experiments are being tried to render the outside surface proof against driving rains and damp atmosphere by the introduction of lime, cement, soft soap, water glass, &c., in the finishing coat of mud. The difficulties arise from the proper mixture of mud with either of the ingredients above named, and coating with lime or cement, so as to make a satisfactory adhering coat.

I would suggest one of the following methods as being more practical and efficient. One way is to build a 2½-in. or 3-in. brick wall all round the structure. This is done by building brick on edge instead of the usual method of laying them on the flat, with iron ties at intervals, similar to those used for hollow walls.

The second method is to fasten wood battens to the wood wall-plate which supports the roof, driving the foot of the batten into the ground before fastening the top. Upon these battens, which only need be slating laths, and should be fixed about 12 in. or 15 in. apart, is stretched ⅜-in. fowl-run netting. It is preferable and cheaper to use the painted netting (black) than the galvanised netting. Another and better method would be to fasten "Expanded" metal lathing in lieu of the fowl-run netting. The fowl-run netting is the cheaper. Use the half-mesh X 19 gauge wire—it is the strongest small mesh made.

A coating of cement will not adhere to the earth, but the above is a very cheap way to form a key upon which to render two coats of cement to a total thickness of ¾ in.

As neat cement and sand is not waterproof, I would suggest a mixture of the waterproof powder "Pudlo" in the proportions of 3 lb. of waterproof powder to every 100 lb. of cement if mixed 3 and 1.

I have had a long experience with this treatment when using cement, and it has proved effective against the ravages of damp, rain, &c., in any exposed position.

Sun-baked mud blocks mixed with straw are constantly being used in Norfolk, both in Diss and Watton. They are faced with bricks, and the tenants say they are very warm in winter and cool in summer.

—Yours, &c.,

Excelsior.

July 7, 1916.

TRANSPORT REFORM.

To the Editor of The Surveyor.

Sir, Mr. Collins questions my figures on motor transport costs; they will naturally vary, as they depend on the load; my point, however, is that a manufacturer suits his vehicle to his goods, and therefore obtains the maximum efficiency. The railway company makes its trucks to suit the heaviest load, and on the average obtains a much lower tonnage; thus, in comparison, the cost per ton of goods on the railway is high. Then the motor costs are reckoned on the out and home journey, whereas in my comparison I worked the railway costs on the outward journey only.

The argument that I put forward is that, on the whole of the facts available, there is little to choose between railway transport, even with the clearing house system, and motor transport under good road conditions.

I raise no objection to the clearing house system as such; I doubt very seriously that it will realise the economies that are said to be in its train. That 5,000 vehicles will do the work of 100,000 vehicles in London is, in my view, absurd. I am inclined to doubt even if there are 100,000 trading vehicles in London—the motor 'bus is the most prominent, and yet there are only 3,000 odd vehicles of this type in London.

The Surveyor

And Municipal and County Engineer.

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The correspondence has been merely to indicate that roads are of much greater importance than the clearing house and railways, and that the adoption of the clearing house will not in any way relieve the pressure on any of the traffic that is now on the roads, and that motor traffic will greatly increase.

Mr. Gill has done me the honour to write to me. I did not doubt there were seventy-four goods stations; I merely do not know where they are, they may be in existence; but I mentioned three of the largest goods stations in the West of London, and if these are not to be dispensed with, then the goods that are now sent to these stations will obviously continue to be sent there. He also says there are fifty passenger stations that are used for goods. A station is worked on commercial lines, i.e. the revenue it receives is put against its working costs, and it pays for itself by the goods and passengers it receives and the clearing house deprives it of part of its revenue, then, according to the scheme, it will have to repay the station for its loss. It would therefore seem to be a case of taking it out of one pocket and putting it in another; the public not gaining anything.

The building that is proposed, if it is the size that one can judge from the drawings in the pamphlet, is open to serious criticism, but I do not propose to touch upon this. I think I have said sufficient to prove my points, and that they should not be replied to, but one left to an indefinite statement that they are dealt with in a book by Mr. Roy Hermman, only tends to strengthen my case. Yours, &c.,

FRANCIS WOOD, M.INST.C.E.,
Borough Engineer and Surveyor.

Fulham.
July 10, 1916.

REINFORCED CONCRETE AND FERRO-CONCRETE.

To the Editor of THE SURVEYOR.

SIR,—In his admirable presidential address to the Institution of Municipal and County Engineers, Mr. Brodie very wisely proposes that a clear distinction should be drawn between genuine reinforced concrete and the nondescript form of construction wherein concrete and steel are used together, but not in scientific combination.

But his suggestion that the term "ferro-concrete" should be applied to the latter cannot be entertained for a moment. The fact is that the terms "reinforced concrete" and "ferro-concrete" are universally employed by engineers, architects, municipal authorities, and the public at large to denote the same thing. Moreover, the designation "ferro-concrete" was adopted some twenty years ago by the late L. G. Mouchel to denote the then new scientific combination of concrete and steel, now officially known as reinforced concrete, which for many years was represented in this country solely by Mouchel-Hennebique ferro-concrete. Although the term was not registered as a trade-mark, it has for a long period of years been identified with the Mouchel-Hennebique system, the reputation of which would clearly suffer if the definitions proposed by Mr. Brodie were generally accepted.

While no distinction can be drawn between "reinforced concrete" and "ferro-concrete," as these expressions are used to-day, there is a very real difference between the scientific combination of concrete and steel, and steelwork merely encased in concrete. The latter is what Mr. Brodie evidently desires to characterise by a new name. The choice of an appropriate designation presents no special difficulty, but it will not be so easy to secure its adoption, either by Government authorities or by those who have reasons for hoping that the superior properties of "ferro-concrete" or "reinforced concrete" may be attributed to varieties of construction simply embodying concrete-protected steelwork.—Yours, &c.,

W. NOBLE TWELVETREES,
Editor of *Ferro-Concrete*.

July 10, 1916.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Doncaster R.D.C. (July 7th. Mr. George L. Pepler). This was an inquiry with respect to the application of the rural council for permission to town plan the parishes of Armthorpe and Kirk Sandall.—Mr. H. M. Marshall, clerk to the council, explained that a series of town-planning schemes were being promoted by the rural council, and there were others to follow, intended, together, to cover the whole of the area within the council's control. The area covered by the present scheme was 1,560 acres, at present purely rural, there being only about 450 inhabitants. The chief reason for the application was that a large colliery was in course of development at Armthorpe, and it was understood it was going to be the largest colliery in this new Doncaster coalfield district. It was part of the enterprise of the colliery company to erect a garden village, which, it was agreed, should fall in with the council's scheme of town planning. The colliery company proposed to put up a thousand houses. The town clerk of Doncaster (Mr. Tovey) stated that the corporation's sewage works were in the district proposed to be town planned. They were proposing a bacterial scheme costing upwards of £100,000, and they would not want that scheme interfered with.

APPLICATIONS FOR LOANS.

Essex C.C.—£6,900 towards the purchase of the site for the new county offices at Chelmsford.

Salford T.C.—£3,029 for the electricity undertaking.

LOANS SANCTIONED.

Abercarn U.D.C.—£800 for a dehydration plant at the gasworks.

Haslingden T.C.—£1,150 for electric mains and £550 for switchgear.

Middlesex C.C.—£372 for making up a road at Hayes.

South Shields T.C.—£1,117 for a motor fire engine.

FORTHCOMING INQUIRY.

	JULY.	£
19.	**Kettering.** For the purpose of the public baths (Mr. F. H. Tulloch) . .	650

Municipal Employees' Service Allowances.—Walsall Town Council have decided, in view of the effect of recent legislation, that in future any allowance given to corporation employees on active service should be based on a stipulation that the total pay should not exceed a man's civil pay by more than 10 per cent, except that in the case of married men holding commissions the limit should be an excess of 25 per cent. The mayor mentioned that it was felt that nothing should be done to discourage men who were in the ranks from accepting commissions.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING AT BLACKPOOL.—(3.)

Following the speeches reported in our last week's issue the discussion at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool on the paper by Messrs. H. R. Aldridge and H. Shawcross, on the subject of

OBLIGATORY TOWN PLANNING

was continued by Mr. J. A. Brodie (Liverpool), who said he thought they could travel a considerable distance in the way of compulsory development if they were satisfied that by travelling in that direction they were going to get satisfactory results. He was not what they called an out-and-out believer in forms and that sort of thing in connection with the present Town Planning Act. They in Liverpool, as the members knew, were fortunate in having their exceptional powers with regard to such matters as roads and the development of any areas within the city boundary. No area could be developed within the city boundary under their 1908 Act, unless that area was developed in such a way as to meet the requirements of the public authority. It was a rather exceptional power, but, at the same time, it was an exceedingly valuable power, and the man who sent in his plan, whether in a town planned area or not, had to show on his preliminary plan the direction of the roads he proposed to make. He thought he could travel in the direction of compulsory town planning if he was assured that the compulsory powers were of a sufficiently general nature. He thought that Parliament ought to say, and to say without quēstion, and in a strong and determined way, that it was the duty of the public authority—whether it was urban or rural—to see that whatever was done in connection with housing and planning was done on first-class and sound lines. If they had certain powers which Liverpool had with regard to roads, if they had certain powers which Liverpool had, fortunately, to reduce street works on certain areas, where the owner or developer would give additional land in places which were of real advantage to the public, they got certain points with which the local authority could negotiate. He believed that rather than follow on the lines of their town planning methods, which he thought were open to very considerable improvement, they ought to deal with it as far as possible on general lines and make it the duty of the authority to see that it was properly done, and give them ample rights with regard to wide roads where wide roads were required, and give them powers with regard to narrow street works and narrower roads than were now allowed where there was no through traffic. They must, of course, have room for two vehicles to pass each other—that was not questioned. With regard to street works, he wanted to say that while they had narrow street works they insisted upon adequate space between houses, so that the question of air space between houses was properly protected.

The President (Mr. J. S. Brodie): I take it that your Act is really a compulsory Town Planning Act?

Mr. J. A. Brodie: It would have been a compulsory Town Planning Act if it had got through Parliament in the form in which it was presented. Parliament in its wisdom gave them some powers for which they were duly thankful. They asked for certain other powers, such as the restriction on the number of houses per acre, and offered certain benefits if owners gave up certain spaces, but Parliament did not pass those; it said that was town planning, and would be dealt with by the general Act.

Mr. T. Salkield (Delhi) remarked that Delhi had recently loomed very large, because it had become the Imperial capital of India. He thought the institution had every reason to be proud of the fact that Mr. Brodie was the engineer selected by the Government of India to advise them on the development of that city. Delhi offered an enormous field for town planning. They had got a population of 300,000, which was chiefly confined within the city walls. Unlike the walls of Jericho, the walls of Delhi were having to give way to the human pressure within those walls. They had recently started on the demolition of some of those walls. His architectural friends were very angry when they started the demolition of the city walls, but they had no historical interest whatever, and they had made a very fine circular road round the city which would in future be found very valuable. To the south of the city the Imperial authorities were carrying out the plans, which were prepared by Mr. Brodie and one or two other gentlemen. The municipality, on their part, were very busy carrying out important works to the west of the city. The first road along the line of the fortifications had been a huge financial success. In dealing with the Town Planning Act, engineers had to be utilitarian, and unless they could show that their schemes were going to pay they would not get very much "forrader." The work had been so successful that they were about to start another scheme on similar lines. They might be very backward in many respects in India, but there were some things in which they were up to date. This question of town planning was one which had been very seriously considered by them. Delhi was in the very enviable position of having the Government of India in their midst, and so they were able to get money from them, which was very helpful to the town.

Mr. H. Aldridge, in reply, remarked that not one of the speakers had objected outright to obligatory town planning. In other words, they had reached the very interesting transitional stage from objection to a new idea to a kind of suspension of judgment in regard to it. Later on, inevitably they came to the visionary point of view when the new idea was accepted. One or two had asked: "What is it going to cost?" Might he counter that with another question: "What is it going to cost you to leave it alone?" That brought him to the remarks made by his esteemed friend Mr. Harpur. He did not tell them one thing. One of the men responsible for raising the status of Dowlais was Mr. Harpur himself. It was because of his loving care that he was prepared to defend it. Alderman Muirhead, speaking of Scotland-road, Liverpool, said they were not keen on dealing with the slums. He was keen on that. He believed it was very largely the fact that they put all the energy they could into the support of Mr. Taylor's Bill that brought about the carrying of that Bill through the second reading stage, when only sixty members voted against it. Whenever people came to him to ask what was being done in this country he always sent them to Liverpool to see the splendid work they were doing there. The moral of it was that they got Dowlais and Scotland roads whether they liked it or not, because towns had grown up higgledy-piggledy. Mr. Hall had told them what had happened at Felling-on-Tyne. The same thing was going on in South Yorkshire. They had this intolerable position that in the district where the people worked the hardest they got the least amenities, and in districts where people had most leisure they had amenities all the time. It was not right; it was not fair. If the men of this country were not dissatisfied with conditions of that sort, then they ought to be, and it was the duty of every man to evoke what Carlyle called the spirit of divine discontent. He was hoping they would send a deputation to the Government, asking them what they proposed to do in the period after the war. He wanted to thank that older visionary, Alderman Bainbridge, for his point about buying stone at 7s. 6d. and selling it at 1s. 6d. The people responsible for such things were not the visionaries at all, but the hard, practical men who never saw an inch beyond their own noses. He believed the Government would back them up very strongly, and, though it might mean more work for surveyors, he was sure they would be pleased to give their help. The more energy they put into the details of this work, the more certain would be the accomplishment of some things which they had regarded as visions.

Councillor Shawcross, in reply to Alderman Muirhead's statement that they did not tackle the slums, said he had worked fifteen years with the Housing Committee, and the first five years were devoted to bringing out the condition of the slums of the big cities. Their work did a great deal to cause the

public to realise the conditions in many of our towns. He had every admiration for the Ruislip-Northwood scheme, and the parts put into it, but the conditions in Ruislip were entirely different to what they were in other parts of the country. That scheme was not at all applicable to Lancashire, and he was certain that they must have something more elastic than that when they got obligatory town planning. He was pleased to hear practically no dissentient voice as to the need for some sort of obligatory town planning. They could let towns like Liverpool and Birmingham have more discretion and control than they could grant to small areas. If they did not do something in the next ten years, perhaps 1,000,000 houses would be built in this country with narrow streets and little bits of back yards.

FUNDAMENTAL AND ECONOMIC CONSIDERATIONS IN RELATION TO TOWN PLANNING.

On the presentation of Mr. Ross Young's paper on this subject reproduced in our last issue Mr. W. HARPUR (Cardiff) said he was entirely in accord with the idea of deciding as to the industrial side of a city before they planned it. That was to him the great mistake which was made up to the present. What were they to plan for, unless they knew what it was to be and where the railways were going. If a railway came they could not say it was not to be constructed because it disturbed their town plan. If works were to be erected they could not be refused because they upset their town plan. If a colliery wanted to sink a shaft, were they to say it could not be sunk because it upset their town plan? This was the right line to go upon, and they must go slowly. If they went too fast they would do more harm than good in the matter of town planning.

Mr. A. H. CAMPBELL (Edinburgh) said they pleaded for going slowly, yet in seven years the number of schemes passed in England could be counted on the fingers of one hand, and in Scotland there had been none. He advised them to take the real practical part of the problem and secure their cities from the narrow, confined streets, flanked as they were by meaner buildings, which spoiled the approach to their city. They could reduce the density of buildings; they could provide open spaces, and they could bring some amenities of country life to town dwellers.

Mr. S. S. PLATT (Rochdale) said he quite agreed that they should start with the preparation of a town plan independent of railways or anything else. If a railway company or anybody else had got anything in their mind as to the development of the district that was the time to bring it along, and not wait until afterwards and then upset everything. With reference to the remarks in the paper about a ship canal linking up the Forth and Clyde, if Mr. Ross Young would go down to Trafford Park he would see the great development which had taken place there from the ship canal. It was amazing what great developments had taken place. Mr. Ross Young mentioned that schemes would often have to embrace the territory of several local authorities. They had found it necessary to do that in Rochdale for the preservation of the amenities of their own area. They had got the power to prepare a scheme of town planning 1,600 acres of land, 500 acres of which were outside their borough in the districts of two other authorities. He would like the members to take careful note of what was brought out in this paper and that of Mr. Shawcross. He had been associated with Mr. Shawcross in two schemes, and could say that he took a broad and cultivated view of the whole question. If they thought it necessary to extend outside their own district, his advice was "go and do it."

Mr. P. C. SMITH (Dunfermline) said he confessed when he read first the paper he thought it very visionary. He said "Ross Young wants us to start a town plan at Edinburgh and finish it at Greenock." The paper was really an argument for the obligatory town planning of rural districts. Take his own district of Dunfermline, where development was taking place and where they had a town plan. The neighbouring burgh promised to town plan for themselves, but since they gave the promise nothing had been done, and the town plan of Dunfermline was practically cut through at the confine of the other burgh. If they would not town plan, some compulsory powers ought to have been applied, so that the scheme on the east side of the city should not be spoilt.

Mr. A. W. WARD (Shrewsbury) said he would like to say a word in appreciation of the paper, which was packed full of common sense. The author said the time had arrived when the question of better organised transport facilities seemed to be on the point of a rapid transformation, and when all grades of traffic would be dealt with in a more scientific manner. Coming as he did from Shrewsbury, the centre of an agricultural county, that appealed to him. Before going there he never thought of freightage and the carrying of goods to market expeditiously and cheaply. When were they going to see that the canals were no longer made derelict? When were they going to have some proper plan for rural districts and the carrying of their produce? If ever there was a strong argument for obligatory town planning, it was the density of the population of Belgium. In Belgium there were only four towns of over 100,000 population. Yet the density of the population of Belgium—a country less than the size of Yorkshire—was twice that of Bengal, which had the second highest density in the world. Was there not something for this country to learn in that?

Mr. Ross YOUNG, in replying, said he knew Mr. Campbell was very impatient about some of his schemes, which had been hung up for a good time, and he seemed to be rather irritated that he should go back to the A B C of town planning. Mr. Smith had said that if he (Mr. Young) had his way he would plan all the way from Edinburgh to Greenock. Well, that included the industrial belt of Scotland, and if he had his way he would have a town plan for that area.

(To be continued.)

ROAD MAINTENANCE IN HEREFORDSHIRE.

"HEAVY EXPENDITURE AFTER THE WAR."

Mr. G. H. Jack, M.INST.C.E., county surveyor of Hereford, states in his annual report that his estimate for the year ended March last has been underspent to the extent of £10,238. "This means," he says, "that the useful work of this department has been impaired to this extent. The rural main roads have suffered to the extent of £8,655. It has been quite impossible to obtain the necessary materials, haulage and labour. All I can say is that the best has been done under exceptionally trying and difficult circumstances."

The cost per mile of the rural main roads in the county was £63, as compared with £75 in the previous year, and that of the urban main roads £176, as compared with £213 in 1914-15.

Mr. Jack warns the county council that the impossibility of executing necessary road repairs now will mean a heavy expenditure after the war. "The cost of reinstatement," he points out, "will be much higher a year hence than it would be at the present time, and many lengths may have to be entirely recoated."

Dealing with Road Board work, he remarks that the assistance received from the board has been a very great benefit in strengthening and resurfacing parts of the principal main roads. The work of surfacing with tar-macadam during the ensuing year is estimated to cost £7,675. This will enable the council to put a wearing surface upon the foundation work which was laid down in previous years. It was hoped that the scheme of road improvement would be completed this year, but it may be necessary to carry the work on for some time longer owing to the shortage of labour and other difficulties.

Mr. Jack's office staff, which numbered seven before the war, has now been reduced to one clerk and an office boy.

New Water Supply for Holderness. The inauguration of the new water supply provided by the Hull Corporation for South Holderness took place last Friday. The new area comprises 200 square miles, and the townships of Hedon, Patrington, and Withernsea are included. Two reservoirs and a water tower of a total storage capacity of 400,000 gallons have been constructed near Withernsea, one to supply Withernsea and the other for the extensive rural district of South Holderness, including Patrington. Both reservoirs are constructed of reinforced concrete.

Sheffield Sewage Disposal Works.*

By JOHN HAWORTH, F.C.S., Manager and Chemist of the Sewage Disposal Department.

The area of the city of Sheffield is 24,886 acres, and the estimated population is 477,228. The present sewage disposal works serve this population, together with that of the outside districts of Blackburn (780 persons), part of Worthy rural district (9,000 persons), and Dore (1,732 persons), the sewage from which is treated under agreements with the city council. The normal dry-weather flow is approximately 15,000,000 gallons per day, of which 3,500,000 gallons consist of trade waste waters, but this volume has been considerably exceeded since the war commenced, owing to munition work.

The whole of the city is drained by gravitation to the main disposal works, situated at Wincobank, with the exception of a small proportion which is dealt with at the Tinsley works, which adjoin the main works.

In the year 1884 works were designed by Mr. G. Alsing, and constructed on part of the present site at a cost of £44,730 (including land) for the purpose of treating the sewage by lime precipitation. These works were opened in 1886, and were designed for a flow of 10,000,000 gallons per day. For some years the sewage was treated during eighteen hours only out of the twenty-four each day, and the sewage was allowed to pass to the river in an untreated condition during the remaining six hours at night. Later the treatment was made continuous.

At the time of their opening the works were considered to be of an excellent type, and they no doubt produced a great improvement on previous conditions. The rapid growth of the city, the population of which increased from 304,720 in 1886 to 352,760 in 1896, and the introduction of the bacteriological systems of treatment, and the demand for treatment of storm water, necessitated further extensions and improvements.

In the year 1900 the corporation obtained powers to purchase further areas of land, and 246 acres in all have been acquired for sewage disposal purposes. A scheme for the extension and remodelling of the works was therefore prepared and carried out by the city engineer (Mr. Charles F. Wike, M.INST.C.E.). The scheme was placed before the Local Government Board in 1904, construction commenced in 1905, and the first section was put into operation in 1909. The scheme was completed in 1914, at a cost of £298,143, including lands actually occupied by the works.

The old works, except the shell of the main building, have practically disappeared. The works now consist of four sets of catchpits, equal in capacity to 1/48th of the dry-weather flow. Two sets are remodelled from the old pits, and are fitted with screens for hand raking, and fixed dredgers for cleansing purposes. The two new catchpits, of modern type, are provided with mechanical screens and an electrically driven travelling dredger for removal of the deposited solids directly into railway wagons.

SETTLING TANKS.

The settling tanks are seventeen in number, with a capacity approximately equal to the dry-weather flow of sewage. They are operated on the continuous flow principle, and have proved efficient in removing the solid matters.

SLUDGE.

The deposited sludge is passed by gravitation to two sludge wells in the main buildings, from which it is pumped by three centrifugal pumps to underdrained drying lagoons, where it is air-dried to a moisture content of 80 to 85 per cent. The sludge is then removed by rail to a tip 6 miles lower down the valley, about 1,200 to 1,500 tons per week being thus disposed of.

CONTACT BEDS.

After leaving the settling tanks the settled sewage is treated on 46 acres of primary contact beds and then discharged to the river. Twenty-nine and a-half acres of the contact beds are divided into ½-acre units.

The medium employed is screened clinker and slag, laid to an average depth of 4 ft. 3 in. in graded layers. The under-drainage, laid on concrete floors, consists of tiles, chiefly of semi-circular section, placed in rows 10 ft. apart.

The remaining 16½ acres of beds are similar in construction to those described, but are divided into approximately 1-acre units, each provided with special outlets, so that they may be used either as ordinary contact beds or as storm filters by streaming the sewage through continuously.

The capacity of the works is 64,500,000 gallons per day, but the main conduits, &c., are constructed for a flow of 110,000,000 gallons per day, extension thus being provided for.

The volume of sewage treated is accurately measured by an installation of four 48-in. Venturi meters.

The main buildings contain boilers, engines, dynamos, catchpits, sludge wells and pumps, valve-rooms and workshops.

The laboratory and offices form separate blocks of buildings.

A scheme for secondary treatment, to consist of percolating filters, with power-driven distributors, humus tanks, and accessories, for the rapid aëration and filtration of the primary effluents, has been prepared. The scheme has been submitted to the Local Government Board, but was postponed during the war.

A scheme for pressing the sludge is also under consideration.

EXPERIMENTAL WORK WITH REFERENCE TO THE PURIFICATION OF SEWAGE BY AERATION, ACTIVATED SLUDGE, &c.

A short description of some experimental work carried on at Sheffield is now presented. Although these experiments are by no means complete, and have been retarded on account of shortage of staff and pressure of work due to the war, the description may be of interest and furnish some matter for useful discussion.

At the period when the main extension scheme was approaching completion it was considered probable that some form of secondary treatment of the primary effluents might be needed.

While the primary effluents are usually incapable of putrefaction, at times colloidal solids separate out on standing, and they are particularly liable to this effect on account of the large volume of trade wastes, containing iron and other metallic salts, hydroxides and mineral acids discharged into the sewers, and present in the sewage at the outfall works. Experiments were therefore commenced about four years ago in order to determine the most suitable and economical methods by which the primary effluents from the contact beds might be rendered at all times satisfactory. An experimental plant was constructed, consisting of tanks, pump, motor, &c., for the purpose of conducting the necessary experiments.

AERATION.

It was found that, on standing in contact with air, opalescent and cloudy effluents became quite clear after about twenty-four hours. Experiments were therefore made in order to bring about, if possible, the rapid deposition of colloidal and other solid matters with subsequent clarification.

These experiments consisted of: (1) Aëration by jets of air; (2) aëration by forcing air through porous substances, such as land tiles and silica bricks; (3) aëration by causing the liquids to fall in sprays; (4) aëration by rapid treatment on percolating filters of varying depths; (5) sand filtration; (6) precipitation by chemicals.

All these methods produced the effects desired to a greater or less extent, but by means of the percolating filter effluents of high purity, clear and free from colloidal matters, were obtained.

Primary effluents have been regularly treated in this manner at the rapid rate of 800 to 900 gallons per day per cubic yard of material with satisfactory results over a period of at least four years.

* Paper read at the Annual Summer Conference of the Association of Managers of Sewage Disposal Works held at Sheffield last Saturday.

The following chemical results may be taken as typical:—

	Parts per 100,000. Liquid treated.	Sprinkler Effluent.
Oxygen absorbed, four hours' test...	2·51	0·68
Nitric nitrogen	—	0·72
Dissolved oxygen test. Oxygen absorbed in five days at 18·3 Cent.	—	0·63
Suspended solids	—	Traces only

The effluent, when diluted with tap-water in the proportion of 4 effluent plus 5 tap-water, and the mixture aerated at 14·5 deg. Cent. (equal to two parts dissolved oxygen per 100,000), and then incubated for five days at 18·3 deg. Cent., invariably absorbed less than 2 parts of oxygen per 100,000, and were therefore well within the Royal Commission standard.

The scheme for secondary treatment referred to in the general description of the disposal works was based upon the results of these experiments. It may, however, be pointed out that while the early experiments which were made by forcing air through porous substances, such as land tiles and silica bricks, did not yield such hopeful results, there was an incentive to continue the experiments, inasmuch as attention had then been drawn to the use of activated sludge in combination with aëration. Consequently it was thought that useful information might be obtained by applying activated sludge to the treatment of primary effluents.

In two of the experimental tanks, fitted with diffusers, sludge was activated by the usual method. In one tank primary effluents and mixtures of these effluents with settled sewage were dealt with, and in the other settled sewage was treated.

The results have proved both interesting and instructive. In the case of the tank treating primary effluents with settled sewage, deposition of colloidal matters is obtained, but, bearing in mind the large volumes of this liquid which can be dealt with on the percolating filter and the greater simplicity of the process, no advantage would be gained by adopting the former.

	Parts per 100,000. Liquid treated.	Effluent.
Oxygen absorbed, four hours' test...	3·47	1·03
Nitric nitrogen	—	0·25
Dissolved oxygen test. Oxygen absorbed in five days at 18·3 Cent.	—	1·31
Suspended solids	—	Traces only.

The effluent, when diluted with tap-water in the proportion of 4 effluent plus 5 tap-water, and the mixture aërated at 14·5 deg. Cent., and then incubated for five days at 18·3 deg. Cent., invariably absorbed less than 2 parts of oxygen per 100,000, and were thus well within the Royal Commission standard.

In the case of the tank treating settled sewage, good results are also obtained.

The effluents are usually, with normal sewages, excellent in character, as the analytical results indicate, and the sludge separates rapidly and distinctly. The alluring prospect of a possibility of purification without filters has led to further investigations.

	Parts per 100,000. Liquid treated.	Effluent.
Oxygen absorbed, four hours' test...	4·67	1·69
Nitric nitrogen		0·40
Dissolved oxygen test. Oxygen absorbed in five days at 18·3 Cent.	—	0·21
Suspended solids	—	Too small to estimate in 250 c.c. of the liquid.

The effluents, when diluted with tap-water in the proportion of 4 effluent to 5 tap-water, and the mixture aerated at 14·5 deg. Cent., and then incubated for five days at 18·3 deg. Cent., with a few exceptions absorbed less than 2 parts of oxygen per 100,000 and were within the Royal Commission standard.

Briefly, the following are the results arrived at:—

(1) Well-clarified effluents are usually obtained which are within the commonly accepted limits of impurity allowable.

(2) It is found that discharges of acid trade wastes, such as occur in the Sheffield sewage, destroy the efficiency of the sludge for a time. On one occasion a particularly strong discharge resulted in the activity being destroyed, and aëration for several weeks was required before clarified effluents could again be obtained. This inhibitory action is more or less pronounced, and consequently great care is necessary to render such abnormal discharges neutral in character, and to equalise their flow so as to render such sewage amenable to purification by this process. A still more important point must be considered—namely, the effects of discharges of trade effluents containing and consisting essentially of chemical solids of heterogeneous composition upon the activated sludge.

(3) The porous tiles became choked after a few months' use, owing to dust and grease in the compressed air, and also by bacterial masses growing through the pores of the tiles. This latter fact has also been proved in connection with the Pasteur-Chamberland porous porcelain tube filter.

(4) Uneven aëration occurs by reason of unequal porosity of the tiles.

(5) Tiles have cracked, with the result that the air escapes at one place, and the tank has had to be stopped for repairs. This unsatisfactory feature in the use of porous tiles requires serious consideration.

These unsatisfactory features lead one to the conclusion that, while sewage may be purified by means of activated sludge, the mode of application leaves room for much investigation and improvement before its practical utility is proved. Experiments have therefore been made in connection with devices for the aëration of liquids without the use of porous media, and in this direction some of the latest experiments will now be described.

During a discussion on this question with Mr. F. Scudder, F.I.C., F.C.S., of Manchester, he described to me a series of experiments on the aëration of crude sewage which were made by him in 1881, in collaboration with the late Dr. Angus Smith, and called my attention to an apparatus designed for the oxidation of oils, &c., devised in the year 1880 by Dr. Storer, and which was used in Angus Smith's experiments. As a result of this, and with the aid of valuable suggestions by Mr. Scudder, apparatus has been constructed which promises satisfactory results, of which several small types may be seen in operation.

The apparatus consists essentially of a narrow cylindrical tube placed vertically and fitted with a central spindle, bearing either an archimedean screw or a series of suitably shaped propeller blades. A number of the blades are within and others projecting below the lower end of the tube. The top of the cylindrical tube is placed at a suitable depth beneath the surface of the liquid to be aërated. On rotating the spindle at a rapid rate the liquid is merely circulated down the cylindrical tube, but on the insertion of a small air pipe within the edge of the cylindrical tube a large volume of air is sucked in and distributed into the liquid at the lower end of the cylinder. The mixed water and air rise up on the outer side of the tube ready to flow in again, and thus the aëration is continuous.

The apparatus is at present experimental in character, but, as a mechanical means for circulating the sludge and at the same time giving abundant aëration, has so far proved to be simple and effective without many of the disadvantages to which aëration by forcing of compressed air through porous slabs, &c., is liable.

It should be observed that two functions are performed by the air in the activated sludge process as now operated—viz., primarily, the supply of oxygen for maintaining the bacteriological and chemical action and efficiency of the sludge; and, secondly, the agitation of the sludge with the liquid.

As only a small proportion of the air is used for oxidation, and the larger proportion for circulation it becomes questionable whether it is economical to use compressed air for purposes of agitation, or if mechanical agitation, which would carry in probably the minimum amount of air necessary, would work as efficiently as the more expensive compressed air plant.

With this aim two further experiments were devised:—

(1) A series of perforated ordinary steam pipes was laid at the bottom of a small tank and connected to the compressed air supply. Over the pipes, approximately 2 ft. of clean clinker or slag, broken into approximately ¾-in. cubes, was laid. The tank was then filled with settled sewage, and air bubbled through for about five hours.

The resulting effluent was found to be clarified, non-putrescible, and in all respects a satisfactory one. A partially septic and black tank liquor treated by this method becomes bright and clear after one hour's aëration, and after four to five hours is amply purified.

One of the tanks has been in daily operation for about nine months, and continues to give good results.

	Parts per 100,000. Liquid treated.	Effluent.
Oxygen absorbed, four hours' test...	4·97	0·92
Nitric nitrogen	—	1·15
Dissolved oxygen test. Oxygen absorbed in five days at 18·3 Cent.	—	1·89
Suspended solids	—	Too small to estimate in 250 c.c. of liquid.

The effluents when diluted with tap-water in the proportion of 4 effluent to 5 tap-water, aërated at 14·5 deg. Cent., and then incubated for five days at 18·3 deg. Cent., with a few exceptions absorbed less than two parts of oxygen per 100,000, thus being within the Royal Commission standard.

(2) The second experiment consisted of a small iron tank having a semi-circular section at the bottom. A shaft was fixed lengthwise through the tank, and to it were attached two hollow paddles of special shape, so arranged that in the lowest position the paddle nearly touches the bottom of the tank and in the upper position it is approximately at the top of the tank. The tank was charged with humus washed from material taken from a contact bed together with sewage, the proportionate volume of humus being 25 per cent of the sewage. When the paddle is rotated the blades leave the liquid at the surface and trap a small volume of air, which is carried into the liquid and discharged therein. Thus the mixture of humus and sewage is kept continuously in motion, and a definite quantity of air is discharged into it by each revolution of the paddle. The paddle is revolved fifteen times per minute.

After several weeks' operation the humus was found to become fully activated, and during the last six months crude sewage has been treated daily with satisfactory results, as the analytical table indicates.

	Parts per 100,000. Liquid treated.	Effluent.
Oxygen absorbed, four hours' test...	4·81	1·17
Nitric nitrogen	—	0·66
Dissolved oxygen test. Oxygen absorbed in five days at 18·3 Cent.	—	0·57
Suspended solids	—	Too small to estimate in 250 c.c. of liquid.

The effluents, when diluted with tap water in the proportion of 4 effluent to 5 tap water, aërated at 14·5 deg. Cent., and then incubated for five days at 18·3 deg. Cent., invariably absorbed less than 2 parts of oxygen per 100,000, thus being within the Royal Commission standard.

The results of these two experiments show that the aëration by minute bubbles of air, such as through porous tiles, is unnecessary, and that mechanical circulation, combined with minimum aëration, is efficient. Both these experiments are still in operation.

GENERAL CONCLUSIONS.

The general conclusions drawn from the experiments which have been described may be summarised thus:—

(1) That a normal sewage may be purified by the activated sludge process.

(2) That trade wastes may interfere seriously with the process.

(3) That further investigation is needed with respect to modes of application of the sludge to the sewage, periodical removal of the surplus sludge and the effect of such removal on the continuing results of purification methods of aëration, costs of plant and upkeep, before older plants and methods can be abandoned.

(4) That skilled control of the process will be essential.

(5) That, while the resulting sludge is undoubtedly richer in nitrogenous organic matter than ordinary sewage sludge, it remains to be proved by actual agricultural trials that such nitrogen is in a form suitable for the ready assimilation by plant life, and that as a fertiliser its superiority over humus can be established, as up to the present humus sludge derived from sprinkler filters, which is also richer in nitrogenous organic matter than ordinary sewage sludge, has not been appreciated by the agriculturist as a fertiliser, in spite of its availability in large quantities at many sewage works in this country during recent years.

PERSONAL.

Mr. A. Garrett has been appointed surveyor and inspector to the Drayton (Salop) Rural District Council during the absence of Mr. W. Cotterill with the Forces.

Mr. G. Frier, sanitary inspector, will carry on the duties of Mr. E. C. Moorhouse, surveyor to the Melton Mowbray Rural District Council, during his absence on active service.

Mr. J. Worsfold, sewage works manager to the Hungerford Rural District Council, has been appointed to a similar position under the East Barnet Valley Urban District Council.

Mr. P. G. Killick, borough surveyor of Finsbury, has had a son wounded in the recent fighting on the western front. At the meeting recently of the borough council the Mayor (Alderman Henry B. Barton, J.P.) expressed the sympathy of the members with Mr. Killick.

Mr. W. H. Hill, chief assistant borough engineer and surveyor of Kensington, who has been carrying on the duties of borough engineer since the resignation of Mr. A. R. Finch, has, pending the filling of the vacancy, been appointed acting borough engineer and surveyor, at an additional salary of £120 a year, with an honorarium of £50 for extra services during Mr. Finch's absence on sick leave.

Mr. Greville H. Montgomery, so well known to our readers for his success in raising the Building Trades Exhibition to an institution of international value and interest, is to be congratulated on being alive and in his usual vigorous health, notwithstanding persistent rumours to the contrary. Sympathetic enquiries at his office on Wednesday were answered by Mr. Montgomery in person, who considers the rumours are exaggerated.

Mr. F. P. Dolamore, who, as stated last week, has been appointed borough engineer of Bournemouth, has been in the service of the town council for twenty-five years, having been originally appointed engineering assistant. Previously he had been chief assistant to Sir James Lemon at Southampton. His promotion to deputy borough engineer of Bournemouth took place nineteen years ago, and in this office, under the late Mr. F. W. Lacey, he was responsible for carrying out many important municipal schemes, including remodelling the main drainage, construction of a tramway system with necessary street widenings, construction of Meyrick and Queen's golf links and parks, and the construction of the Undercliff drives and paths.

Sheffield University last year gave a First Class B.A. degree to Miss C. W. MacBrair, elder daughter of Mr. and Mrs. W. M. MacBrair, of Sheffield, and niece of Mr. R. A. MacBrair, city engineer and surveyor of Lincoln; recently, as the result of a final examination, they have granted the M.A. degree.

OBITUARY.

Mr. John Allan, road surveyor to the Huntley District Committee of the Aberdeenshire County Council, died recently, we regret to state.

Electric Lighting Charges at St. Helens.—An increase of 10 per cent in the price of electric current was agreed to at a meeting of the St. Helens Corporation last week. Alderman Sir Joseph Beecham, in moving the adoption of the minutes of the Electricity Committee, stated that ten years ago they reduced the price to 3½d. per unit, and charged nothing for meter rents, and for towns of the character of St. Helens that was about the lowest charge in the country. There were only about 5 per cent of the municipal undertakings of the country that did not charge meter rents. When they reduced the price to 3½d. the committee only paid 6s. a ton for coal. Coal had gone up in price, and no alteration was made until a few months ago they put 10 per cent both for power and lighting. The average price two or three months ago was 16s. or 17s., and they were now paying 21s. or 21s. 6d. When they took into consideration the inferior quality of the fuel supplied, it meant an increase of 300 per cent in the price of fuel. Against this the increase of the price was 20 per cent. That would make the charge just under 4½d. per unit. He quoted figures to show that this was below the charge in most other places.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Accrington T.C.—It has been decided to enlarge the tramway offices at the market.

Grantham T.C.—It has been agreed to provide stabling for seven horses, and also cart sheds, at a cost approximately of £800.

South Shields T.C.—It is proposed to build an infectious diseases hospital near Cleadon from plans prepared by the borough engineer, Mr. L. Roseveare, but the scheme will not take effect till after the war.

HOUSING AND TOWN PLANNING.

Birmingham T.C.—At the meeting of the city council last week authority was given to prepare an amending scheme in respect of an area of about 247 acres included in the East Birmingham town-planning scheme. It was explained that the authority was necessary to alter the planning of three roads to make them conform with the continuations of those roads coming within the North Yardley scheme.

Leeds T.C.—In moving the adoption of the minutes of the Improvements Committee, Alderman F. M. Lupton (chairman) called special attention to the resolution authorising the city engineer, Mr. W. T. Lancashire, to prepare plans for a Moortown town-planning scheme. Part of the scheme, he said, included part of Alwoodley, which was within the Wharfedale Rural District Council's area. The chief reason for that was that the projected ring road round the city would almost necessarily pass through part of that area.

Worcester T.C.—A report is to be prepared upon the advisability of a town-planning scheme for the Blackpole district.

MOTOR TRANSPORT.

Finsbury B.C.—The borough council recently authorised the purchase of a motor road sweeper at £675.

Friern Barnet U.D.C.—A committee is to consider and report upon the provision of a motor fire engine.

Manchester T.C.—The substitution of motor-'buses for tramcars in certain districts is being considered by the city council.

REFUSE COLLECTION AND DISPOSAL.

Southall-Norwood U.D.C.—The Local Government Board have been asked to consider favourably a proposal by the council to spend money on the provision of a refuse destructor or other means for the disposal of refuse.

Surbiton U.D.C.—It has been referred to a committee to consider whether the removal of house refuse in the district could not be carried out cheaper by the council itself, by direct labour, with its own horses and mechanically propelled vehicles. Consideration is also to be given to the collection and sale of waste paper.

Tilbury U.D.C.—The surveyor, Mr. S. A. Hill-Willis, has received instructions to prepare a specification for the proposed refuse destructor.

ROADS AND MATERIALS.

Barrow T.C.—The town council have accepted the tender of Highways Construction, Limited, at £670, for repairing a length of Abbey road with Mexphalte, the company to guarantee the work for five years.

Denbigh C.C.—It was reported that the Road Board had allotted £1,000 to the council for road improvement purposes, it being intimated that the grant would be increased if it was necessary in the national interests.

Derbyshire C.C.—The estimate for the surface tarring of the roads is £9,675, and it was stated at the council meeting recently that the Road Board would be prepared to pay a moiety of this.

Dover T.C.—At the last meeting objection was raised by councillors to the use of clinker ash on tar-painted roads. Councillor Walmisley said it was a very unsatisfactory material to use. Speaking as an engineer, he thought there was nothing like sand and broken stone or metal for the purpose. If they used clinker ash and had fine weather, it was soon ground down to a fine powder, and flew about and got down people's throats, and if it happened to be wet, it was soon converted into a thick and unpleasant mud, which was very unsatisfactory.—The Mayor said that the deputy engineer, Mr. Crummack, would say that he was of the councillor's opinion; but, unfortunately, he was not able to get the other material.—Councillor Gatehouse asked why they could not get Thames ballast, which was better than cinder.—Alderman Lewis thought they could use Broadstairs sand.

Essex C.C.—It has been agreed to resurface with Tarmac part of the Barking to Southend main road, at an estimated cost of £4,000.- Application is being made to the Road Board for a grant of £3,000 for road tarring.

Ilford U.D.C.—The tender of Messrs. Parsons & Parsons, at £369, has been accepted for making up the right of way at the rear of the town hall.

Kidsgrove U.D.C.—An estimate of £400 has been passed for road improvements in Kidsgrove Ward.

Market Drayton U.D.C.—The Highways Committee have been asked to report upon a proposal for a street improvement at the junction of Shropshire-street and Cheshire-street. The scheme involves the acquisition of certain properties, and the approximate cost is £300.

Norfolk C.C.—The county surveyor, Mr. W. H. Gladwell, reported to the Eastern Highways Committee that he had received a communication from the surveyor to the Cromer Urban District Council stating that his Highways Committee were prepared to carry out the necessary tarring to maintain the roads in their present condition on the understanding that the county council would pay the whole of the cost. It was stated that if the matter was delayed until the autumn granite would be required. Tarring in the district cost about 1d. per yard; one or two roads were wearing out, and unless done now would cost 1s. 2d. per yard for granite in the autumn. After discussing the matter the committee decided not to depart from their rule, viz., to pay one fourth of the cost of the tarring by the urban authority.

Pickering R.D.C.—No objection has been offered to the proposal of the county council to the tar-spraying of the Whitby-road. The cost would, it was stated, be borne by the Government.

Swansea T.C. — The Highways Committee have approved the scheme of the borough surveyor, Mr. J. R. Heath, for a new 60-ft. line of frontage for Park Wern-road to Gnoll-avenue. With respect to the powers over new omnibus routes in the Local Government Emergency Provisions Act, the borough surveyor said he thought the town clerk should make a report, as the Act was very loosely worded. The mayor said owing to the different interpretations capable the Act should be boiled up and rehashed, for no one understood its meaning. The borough surveyor said the intention could have been put plainly in a few words. The matter was left to the town clerk.

SEWERAGE AND SEWAGE DISPOSAL.

Alford U.D.C.—The Sanitary Committee have been authorised to purchase two 5-in. pumps at a cost of about £60.

Chertsey U.D.C.—With respect to the proposed sewage disposal scheme an intimation has been received from the Local Government Board that a loan cannot be sanctioned for the purpose until after the war.

Croydon T.C.—It has been agreed to effect alterations and extensions at the South Norwood sewage farm at an estimated cost of £1,500.

Grimsby R.D.C.—A committee has been authorised to consider the advisability of a surface water drainage scheme for Immingham.

Langholm T.C.—It is understood that an agreement has been reached by which the town council are to carry out a sewage purification scheme. The immediate execution of the work is contingent upon a satisfactory contribution towards the cost being obtained from the Ministry of Munitions.

Leyton U.D.C.—Mr. A. P. I. Cotterill, M.INST.C.E., has prepared for the council a report on sewage disposal, in which he states that of all the alternatives to chemical precipitation that of activated sludge treatment holds out the greatest possibilities. It is the natural development of methods, aiming at the intensive cultivation of bacteria upon which experts have been working for many months. He then commends the council to set aside a sum for rearranging a portion of one of the existing tanks to treat at least 20,000 gallons per day, and to commence a series of experiments. With reference to this proposal, the surveyor, Mr. E. H. Essex, has been instructed to obtain further detailed information from Manchester, Salford, Stamford, and Worcester for submission to the Public Health Committee and if deemed desirable to visit one or more of the places mentioned to inspect the actual operations and report.

Martley R.D.C.—A report was received from the engineers of the Hallow sewerage scheme with reference to an obstruction in the sewers. The engineers said that the trouble was not due to any defect in the sewer, but to a jelly-like scum which was in evidence, particularly at one manhole. It was a most unusual circumstance, and one which was very rare in their experience. The best remedy was flushing, and they suggested that special valves, the better to carry out this method, should be installed.—Mr. Lord agreed that it was an extraordinary circumstance. There was a splendid fall.—The inspector was instructed to procure the valves.

Tiverton R.D.C.—An expenditure of £100 has been approved for road drainage at Cruwys Morchard.

Wolverhampton T.C.—The Sewerage Committee report a profit of £2,588 on the year's farming operations at Barnhurst, compared with £2,592 for the previous year.

WATER, GAS, AND ELECTRICITY.

Batley T.C.—The Treasury are being asked to sanction a loan for the provision of new carbonising plant at the gasworks.

Bristol T.C.—The Electrical Committee in April, 1915, received authority from the council to spend nearly £27,000 on a 6,000-kw. turbo alternator, but when the committee went to the Local Government Board for sanction to raise the money the board suggested that they might manage with a machine of half the capacity, and said they would allow a loan of £16,500. The committee "have reluctantly adopted the suggestion," and have accepted a tender from Messrs. Fraser & Chalmers, of Erith, for the provision of a 3,000-kw. Fraser & Chalmers turbine, coupled to a Vickers alternator, and with condensing plant by the British Westinghouse Company, at the inclusive sum of £11,608.

Burnley T.C.—The Local Government Board have sanctioned the proposed work in connection with the Hurstwood reservoir. The estimated cost is £32,000.

Cork T.C.—A letter has been received from the Cork Gas Company regretting that, owing to the great increase in the price of coal and freight, they are compelled to increase the charges for gas consumed in metered lamps by 6d. per 1,000 cub. ft., for gas consumed in unmetered lamps by 7s. 6d. per lamp per annum, and for gas used for buildings and offices by 6d. per 1,000 cub. ft., the increased charges to take effect from July 1st. The Public Works Committee have agreed to send a letter protesting against the proposed increases.

Dawlish U.D.C.—It was reported that the electric light company had declined the council's alternative offer to pay at the rate of 3¼ per cent per annum on their capital outlay in respect of street lighting, in lieu of the 5 per cent as required by the company. The company, however, made the following offer, without prejudice to their rights under the contract, to hold good generally during the period of restricted lighting and the operation of the Summer-time Act: Contract prices for all lamps lighted; £1 15s. per annum per 200-c.p. lamp unlit; 17s. 6d. per 100-c.p. lamp unlit; and 8s. 9d. per 50-c.p. lamp unlit. The council have agreed to these terms.

Edinburgh T.C.—The Electric Lighting Committee report that the deficiency on the account last year was £8,075.

Exeter T.C.—New electric pumping apparatus, capable of delivering 25,000 gallons per hour, has been installed at the corporation waterworks as part of the scheme of extension planned by the city surveyor, Mr. T. Moulding. The new plant assures the city of a continuous and ample supply of water under any conceivable circumstances.

Glasgow T.C.—The great demand which the manufacture of war material has caused for electricity for power and lighting, especially the former, is demonstrated by the fact that the revenue of the corporation electricity department for the financial year which ended on May 31st was £530,720, as compared with £405,372 in the preceding year. This is an increase of £125,348, while in comparison with the revenue of the year 1913-14, which was £378,315, there is an increase of £152,405.

Leyland U.D.C.—It is proposed to ask the Local Government Board to sanction a scheme for additional mains for the extension of the water supply.

Lynton U.D.C.—The surveyor, Mr. W. Yeo, has been authorised to sink a well near the isolation hospital.

North Berwick T.C.—It has been decided to increase the price of gas from 4s. 7d. to 5s. per 1,000 cubic feet.

Nottingham T.C.—The Water Committee report that the water undertaking had been carried on without additional capital obligation. In twelve months' time the city would have a full supply from the Derwent Valley, and distribution would be such that it would be impossible to differentiate the water from the sparkling type which they had enjoyed for generations past.

Startforth R.D.C.—A scheme has been approved for the improvement of the Bowes water supply.

Tipton U.D.C.—A scheme has been adopted for the reconstruction of four beds of retorts at the gasworks on the horizontal system, at an estimated cost of £2,000.

Tunbridge Wells T.C.—The nett profit on the electricity undertaking last year was £598.

Walsall T.C.—The report of the gas undertaking for last financial year shows a nett profit of £7,560.

Woolwich B.C.—A boiler, superheater, and economiser are to be provided for the Globe-lane station, and, subject to the sanction of the Local Government Board, it is proposed to extend the electricity mains at a cost of £600.

MISCELLANEOUS.

Bristol T.C.—With respect to a suggestion that two or three members of the Sanitary Committee should attend the Cardiff meeting of the Institute of Cleansing Superintendents, the chairman of the committee said it was important that they should see the motor appliances to be on view there, because the committee were now paying at the rate of £2,000 a month for haulage. The city engineer, Mr. L. S. McKenzie, had suggested to the manufacturers what was likely to be suitable for Bristol, and they had promised to exhibit it. The committee agreed to send a few members experienced in the haulage problem to see the show.

Croydon T.C.—A swimming bath is being used for the storage of furniture of men called up.

Sheffield T.C.—A gross profit of £173,459 was made on the corporation tramways last year. The total income of £455,608 was a record figure, and the nett profit of £95,779 an increase over that of the preceding year of £25,840.

Teignmouth U.D.C.—In regard to the adjustment of accounts as between the highway and gas departments, in consequence of the public lighting being dispensed with, the surveyor, Mr. F. W. Knight, reported that he and the gas manager thought it fair that £390, including the current amount estimated for lighting, should be divided thus—gas department £190, general district fund £200.

FOR OTHER ADVERTISEMENTS
See End of Paper.

WANTED, Clerk of Works (between 41 and 50), with special experience of sanitary plumbing, drainage, and heating, to adapt a large country house for military purposes. Apply to Willcox & Raikes, Consulting Engineers, 63 Temple-row, Birmingham, stating whether married or single and when disengaged, also age and salary required, with particulars of experience and references. (3,046)

WANTED, a Good Second-hand Ten-ton Steam Roller, with Scarifier attached. Price and particulars to F. Hargreaves, Surveyor, Consett, Co. Durham. (3,047)

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather to be regretted that only five out of twelve papers came under discussion at the annual meeting of the Institution of Municipal and County Engineers at Blackpool? Is it not a pity that the "menu" of papers to be read was so large that only the *hors d'œuvres* could be taken, and that many who had come to read, or discuss, other papers than those on town planning, &c., had to go empty away? What must be the feelings of the members who had taken the trouble to write these papers?

* * * *

Was not Lord Crewe's recent pronouncement at the Imperial College of Science and Technology of great importance in connection with the future teaching of science in our national system of education? Is it not well that the Government have appointed a Special Committee to inquire into the position of natural science as regards education, with a view to the promotion of the advancement of pure science in our schools and colleges, and is it not to be hoped that this Committee will be able to change our present "classical" system of education to one of a more practical and useful description?

* * * *

Is not the position of the surveyor with regard to the men under him beginning to reach a very dangerous state in some districts? Is it a fact that at a meeting of the Shildon, Durham, Urban District Council recently the question of the dismissal by the surveyor of a workman was referred to a sub-committee, after a full explanation by the surveyor, and after his action in the matter had been approved by the General Purposes Committee? If this interference with the power of the surveyor is to continue, will not the result end in chaos of the worst description, and will not all discipline disappear? What sort of a position can a surveyor hold if he is not to be responsible for his workmen, and councils are to take this responsibility out of his hands? Where is Democracy drifting?

* * * *

Is not Alderman Davies, of the Swansea Town Council, to be congratulated on his suggestion that the spare land at the corporation cemetery should be used as a model kitchen garden where ratepayers could obtain advice from a practical gardener as to the best method of utilising their own gardens for the production of vegetables and fruit? Do we not all heartily wish Alderman Davies every success in carrying out his excellent and patriotic suggestion?

* * * *

Is it not satisfactory to find that there was a general consensus of opinion in the discussions on the papers on town planning at the recent annual meeting at Blackpool that the roads, sewers, and general planning was the work of the surveyor, and that the design and erection of the buildings and the general beautification of the scheme should be the work of the architect? Does not this go a long way towards settling the vexed question as to who should prepare and carry out a town planning scheme?

* * * *

Is not the Mayor of Stockton-on-Tees to be congratulated on his patriotic action in refusing a proposal of his council to appeal on his behalf for his exemption from military service until the end of his year of office, he having attested under Lord Derby's scheme? Is not his example one that could be followed with advantage by a large number of men who use every endeavour to escape national service?

* * * *

Is it not a "feather in the cap" of the activated sludge process that the Worcester Corporation, who have experienced endless trouble with their sewage disposal works, should have decided to adopt this process, after a long and exhaustive trial of a small installation at their works?

* * * *

Will not the great rise in the price of petrol affect the profits of the motor-'bus companies, and if it continues give an impetus to the electric overhead-wire system with railless cars? Was not the experience of the Keighley, Yorks, Corporation confirmatory of this when they abandoned their motor 'buses and introduced the railless system, thus converting an annual loss into a considerable annual profit?

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

DRAUGHTSMAN. July 17th. Southampton County Council. £130 per annum. County Surveyor, The Castle, Winchester.

ASSISTANTS (two).—July 24th.—West Suffolk County Council.—Mr. W. Lionel Jenkins, county surveyor, Shire Hall, Bury St. Edmunds.

CITY SURVEYOR'S TEMPORARY ASSISTANT. —July 24th.—Corporation of Salisbury. £104 per annum.—Mr. Francis Hodding, town clerk, Municipal Offices, Salisbury.

ENGINEER AND MANAGER.—July 24th.—Loughborough Electricity Committee. £300 per annum.—Mr. H. Perkins, town clerk, Town Hall, Loughborough.

DRAUGHTSMEN For war work in a Government aëronautical office in London. — £3 10s. to £1 1s. per week, plus overtime.—Room 344, Adastral House, Victoria-embankment, E.C.

WATERWORKS FITTER.—Cirencester Urban District Council.—Mr. T. Hibbert, surveyor, Cirencester.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

DUNDEE.—July 17th.—For the execution of jointless flooring and painter's work, for the corporation. —Mr. H. Richardson, Electricity Department, Dundee.

DUNDEE.—July 17th.—For the execution of reinforced-concrete foundation, mason, and other works, for the corporation.—Mr. H. Richardson, Electricity Department, Dundee.

EDINBURGH.—July 17th.—For repairs to the electric generating station, for the corporation. Mr. J. A. Williamson, architect, Public Works Office, City Chambers.

HALIFAX.—July 17th.—For additions to the tramway depot, for the Tramways Committee.—Mr. J. Lord, borough engineer, Town Hall.

HALIFAX. — July 17th. — For rebuilding greenhouses, for the Parks Committee.—Mr. J. Lord, borough engineer, Town Hall.

SURBITON.—August 4th.—For repairs and painting at the cottage and buildings in Red Lion-road, for the urban district council.—Mr. F. W. Wood, clerk, Council Offices, Ewell-road, Surbiton.

Engineering: Iron and Steel.

CLACKMANNAN.—July 17th.—For the supply of 200 tons of cast iron pipes and special castings, for the county council. Messrs. Leslie & Reid, engineers, 72A George-street, Edinburgh.

ROTHES.—July 19th.—For the concrete and iron work of a culvert, for the town council. Mr. A. Robb, burgh surveyor.

PLYMOUTH. July 20th.—For the supply of a rotary steam boiler-fed pump, for the corporation.—Mr. E. G. Okell, borough electrical engineer.

RUNCORN.—July 22nd.—For supplying and fixing a 20-ton weighbridge, for the urban district council.—The Clerk, Town Hall.

ENFIELD.—July 26th.—For the erection of new cast-iron hot-water mains and for repairs, for the guardians.—Mr. J. C. S. Mummery, architect, 13 Fitzroy-square, W.

HALIFAX. August 5th.—For the reconstruction in reinforced concrete of Clark Bridge, for the corporation.—Mr. J. Lord, borough engineer, Town Hall.

SINGAPORE.—August 14th.—For the construction of a steel bridge, for the Public Works Department.—Chief Clerk, Colonial Engineer's Office, Singapore.

Roads.

HALIFAX. July 17th.—For the execution of improvement works in Duke-street, for the Highways Committee. Mr. J. Lord, borough engineer, Town Hall.

WELLINGTON. July 19th. For the supply of 800 tons of broken granite, for the urban district council. —Mr. G. Riley, surveyor, 14 Walker-street, Wellington.

BUNGAY. July 19th. For the supply of 1½-in. Mountsorrel granite, for the urban district council. Mr. H. Earl, surveyor.

HEBBURN.—July 22nd.—For works of improvement, for the urban district council. Deputy Surveyor, Council Offices, Argyle-street, Hebburn.

BROADSTAIRS.—July 31st.—For the supply of 500 cub. yds. of pit flints and 160 cub. yds. of pit gravel, for the urban district council.—Mr. H. Hurd, surveyor.

JOHANNESBURG.—August 14th-15th.—For the supply of 1,600 tons of tar or tar substitute, for the municipal council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

RHONDDA.—July 17th.—For scavenging the district in sections, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

OULTON BROAD.—July 22nd.—For the removal of house refuse and cleansing cesspools, for the urban district council.—Mr. E. G. Rand, deputy clerk, Victoria Chambers, Lowestoft.

TADCASTER.—July 28th.—For emptying ashpits, for the rural district council.—Mr. H. C. Wood, sanitary inspector, Tadcaster.

Stores.

WHITEHAVEN.—July 17th.—For the supply of stores, for the Harbour Commissioners.—Mr. J. Tyson, clerk, Harbour Office, Queen's Dock Quay, Whitehaven.

SALFORD.—For the supply of general stores, for the gas department.—Mr. W. W. Woodward, engineer, Gas Offices, Bloom-street, Salford.

Miscellaneous.

EALING.—July 17th.—For the supply of household coal and coke, for the town council.—Mr. W. R. Hicks, borough surveyor, Town Hall, Ealing.

EALING.—July 17th.—For the supply of disinfectants, for the town council.—Mr. W. R. Hicks, borough surveyor, Town Hall, Ealing.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

SOUTH-WESTERN DISTRICT MEETING.

A South-Western District meeting of the Institution of Municipal and County Engineers is to be held at Exmouth on Saturday, July 29th.

Programme.

3.0 p.m.—Meet at council offices, where Mr. County Councillor Crews, chairman Roads Committee, Exmouth Urban District Council, will receive the members.

Read minutes of previous meeting.

3.15 p.m.—Proceed to the Marine Drive Works for inspection, where Mr. Hutton will describe the works. The works comprise: Just completed, approximately ¼ mile of bulk concrete sea-wall, built by Lord Clinton (Engineers, Messrs. Douglass, Lewis and Douglass); approximately ½ mile of reinforced concrete and masonry sea-wall, built by the Exmouth Council (Engineer, Mr. S. Hutton).

In connection with the above and now in course of construction by the Exmouth Council: Approximately 1 mile of reinforced concrete carriageway, 40 ft. wide, with 25-ft. of footpaths (Engineer, Mr. S. Hutton).

Arrangements are being made with the contractors to keep the men working during the inspection.

5.0 p.m.—Tea at the Undercliff Tennis Pavilion (adjoining the works) by invitation of Mr. Crews and Mr. Hutton; after which Mr. Hutton will be glad to answer any questions arising out of the inspection.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

NORTHFLEET. Accepted for the supply of broken ragstone, sand and gravel, hire of steam roller and horses and carts, and the supply of 16,650 gallons of tar, for the urban district council. Mr. J. A. Mitchell, surveyor:

Sand.—J. F. Martin, Greenhithe, 1s. 11d. per yard.
Gravel.—J. F. Martin, Greenhithe, 1s. 4d. per yard.
Tar.—E. G. Holmes & Co., Northfleet, 33d., 33d., and 32d. per gallon.
Steam Roller.—T. Wood & Sons, Limited, Crockenhill, 27s. per day.
Scarifying.—T. Wood & Sons, Limited, Crockenhill, 5s. 6d. per cubic square yard.
Ragstone.—W. H. Bensted & Son, Maidstone, 9s. to 9s. 6d. per yard.
Pit Flints.—J. & B. Martin, Limited, Pinden, 4s. per yard.
Granite.—L. Summerfield, Limited, Kensington, 16s. 8d. per ton.
Horse Hire.—C. Dyke, Northfleet, 13s. per day.

Bexhill's New Isolation Hospital.—A new infectious diseases hospital has recently been completed for the borough of Bexhill. The observation pavilion contains accommodation wards for two males and two females, together with duty room and spacious verandah. A small laundry has been erected adjoining the existing kitchen. The buildings are of brick with rough-cast and local red-brick dressings, plinths and sills, and have slated roofs with red roll ridging. The floors consist of polished pitch-pine blocks in concrete. The heating is by open fireplaces, and the lighting by gas with incandescent inverted burners. The wards are ventilated by means of inlet ventilators at the floor-level under each bed. The whole of the work has been designed and carried out under the supervision of the borough surveyor (Mr. George Ball, Assoc.M.Inst.C.E.). The accounts for the works have not yet been settled, but it is anticipated that the cost of the works carried out, including furnishing, will not exceed £1,150.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JULY.

17-20. Institute of Cleansing Superintendents: Annual Conference at Cardiff.
29. Institution of Municipal and County Engineers: South-Western District Meeting at Exmouth.

APPOINTMENTS OPEN.

WANTED, two or three Working Foremen, used to Tar-spraying and the Laying of Tarmacadam Roads, Footpaths, Playgrounds, &c. Give full particulars and experience and wages required. Must be ineligible for Military Service. Apply Box B., W. H. Smith & Son, Lichfield-street, Wolverhampton. (3,041)

CIRENCESTER URBAN DISTRICT COUNCIL.

WATERWORKS FITTER.

Immediate applications are invited for appointment named above from persons capable to superintend works under the directions of the Surveyor to the Council. A practical knowledge of public supply of water derived from boreholes, and the engines and pumping plant (including experience with suction gas) used for raising the supply is essential; also experience in repairing pumping plant.

Applicants must also be experienced in distribution of supply, including waste and other meters, Venturi meter, electrical water-level recording apparatus for reservoir, the laying of mains and services, fixing of hydrants, sluice valves, &c.

Applicants must be absolutely ineligible for, or totally exempt from, Military Service; they must state age, qualifications, whether married or single, present and previous employment, wages required, and enclose copies of three testimonials addressed to Mr. T. Hibbert, Surveyor, Cirencester. (3,042)

— THE —

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CITY OF SALISBURY.
CITY SURVEYOR'S TEMPORARY ASSISTANT.

The Town Council invite applications from men ineligible for Military Service for the appointment of a Temporary Assistant in the Office of their City Engineer and Surveyor in consequence of the absence of the present Assistant on Active Service.

Applicants must have had experience in a municipal engineer's office.

The appointment to be determinable by a month's notice.

Applications, in candidate's own handwriting, stating age, experience, salary required (the salary previously paid to the Temporary Assistant being at the rate of £104 per annum), when able to commence duties, and accompanied by copies of not more than three recent testimonials, endorsed "City Surveyor's Assistant," must reach me not later than noon on Monday, the 24th instant.

Canvassing is strictly prohibited.

FRANCIS HODDING,
Town Clerk.

Municipal Offices,
Salisbury.
July 6, 1916. (3,043)

WEST SUFFOLK COUNTY COUNCIL.
COUNTY SURVEYOR'S DEPARTMENT.

Two Assistants required temporarily to fill places of those released for Military Service. One Assistant will be engaged chiefly on accounts, the other on correspondence. Applicants must have had experience in a Surveyor's Office.

Applications, in the candidate's own handwriting, stating experience, qualifications, age, salary required, and when able to take up duties, with copies of three recent testimonials, to be received by the undersigned not later than 24th July, 1916.

W. LIONEL JENKINS, ASSOC.M.INST.C.E.,
County Surveyor.

Shire Hall,
Bury St. Edmunds.
July 12, 1916. (3,045)

APPOINTMENTS WANTED.

DEMONSTRATOR.—Lady, experienced (Naval Officer's daughter), requires permanent position; gas, electric light, domestic patents, or similar.—Reply, stating remuneration offered and full particulars, Box 1,576, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,044)

EXPERIENCED Surveyor desires appointment in Mining Engineer's Office with a view to working partnership. Highest testimonials. Terms and fullest particulars to Box 1,574, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,032)

MUNICIPAL Surveyor's Chief Assistant desires appointment, temporary or otherwise. All-round experience sewerage, sewage disposal, surveying, levelling and water supply. Age 24, with military discharge. Excellent references.—Box 1,575, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,036)

PREPARATION FOR EXAMINATIONS.

CORRESPONDENCE COURSES for A.M.I.C.E., STUD.I.C.E., MUNICIPAL AND COUNTY, SANITARY SCIENCE AND SANITARY INSPECTORS, P.A.S.I. and F.S.I. Exams., by a Surveyor, who is F.S.I., A.M.I.C.E. and GRAD.M. and Co.E., all by Exam., with 23 years' municipal and 13 lecturing and coaching experience, assisted by D.Sc.(LOND.), M.A.(CAMB.), with high mathematical honours. Record for past 3 years, all Exams., 90 per cent p. Exceptionally low fees; easy payments.—For further details and testimonials apply Box 892, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

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The Surveyor

And Municipal and County Engineer.

Vol. L. JULY 21, 1916. No. 1,279.

Minutes of Proceedings.

Arterial Roads in Greater London.

At the last meeting of the London County Council an important report was presented by the Improvements Committee in which it was pointed out that the Prime Minister and the President of the Local Government Board have been asked to receive at the end of the present month a deputation in support of the resolutions passed at the second main conference on arterial roads in Greater London. Our readers are already familiar with the terms of those resolutions, which generally seek official recognition for the findings of the conference as to suitable routes. The county council have a general interest in the matter as being the central authority for the planning and execution of street improvements in London. In the past their general policy with regard to road improvements has been necessarily in the direction of improving existing means of communication as and when favourable opportunities have occurred, and the main consideration with them has always been—and very properly so—the degree of benefits to be conferred by any improvement on the general through traffic of London, due regard being paid to the need for improving main roads leading out of London into adjacent districts. The present report does not deal in detail with the proposals of the conferences in regard to new roads within the county of London. It is pointed out, however, that the formal presentation of the recommendations of the conferences to the Prime Minister and the President of the Local Government Board may be regarded as involving some measure of acquiescence on the part of all the authorities represented at the conferences. So far as the council is concerned, in the absence of an expression of its views, it might be considered that the council had withdrawn from the position it took up with the Road Board on the subject of road improvements, and had accepted the conclusions of these conferences as constituting a programme having prior claim on its attention in connection with road improvement and development in London. In order to safeguard the council's position, both for preserving freedom of action for the future and also for maintaining a claim on any Government fund for aid towards the cost of urgently needed London improvements, the Committee consider that the views of the council should be made known to the Prime Minister and to the President of the Local Government Board, if possible before the deputation above referred to is received. The recommendation of the Committee is in the following terms: That, in connection with the proceedings of the conferences on arterial roads in Greater London, the council, while in general agreement with the principle of a far-sighted policy of reservation of routes before land is built on or values enhanced, reserves its opinion as to the best methods for determining routes for arterial roads, and the actual routes for such roads, particularly in the County of London, where conditions are essentially different, as regards road planning, from those obtaining in neighbouring counties, and also reserves its opinions as to the relative importance and urgency of the proposed arterial roads within the County of London in comparison with other road improvement proposals affecting the county; and confirms the views expressed by it to the Road Board on the subject of London improvements and of grants in aid of such improvements from new sources of revenue.

No one will criticise this recommendation on the ground of want of caution. It seems to us, however, to be rather late in the day for a great body like the London County Council to be "reserving its opinion as to the best methods for determining routes for arterial roads." The report of the Committee is very frank as to the reasons for the recommendation. If the schemes for arterial roads are proceeded with, it is said that the council will probably be expected to contribute, and in view of the probable heavy cost involved the council's co-operation as one of a number of authorities in the execution of the schemes might involve the abandonment or postponement of improvements regarded by the council as of greater urgency and necessity from the standpoint of the requirements of the traffic of London. If the State, by assuming control of the preparation and determination of arterial road schemes, is also prepared to accept the financial responsibility for the whole or greater part of the expenditure, whether on capital or maintenance, there would be the danger that any money which the Government may be prepared to allocate in the future for the improvement of roads and road communication may be devoted towards the construction of the arterial roads recommended by the conferences, with the probable consequence that no new source of revenue will be available for the execution of the improvements to which the council would attach greater importance. If, even without assuming financial responsibility for the whole or greater part of the expenditure, a Government department approves and fosters the arterial road proposals of the conferences, the council might be seriously prejudiced in its applications to Parliament for sanction to improvement schemes in London, as it has been the practice in recent years for Government departments, including the Local Government Board, to present to Committees of Parliament reports upon Bills without supporting such reports by evidence which can be cross-examined. The County Council are perfectly right in repre-

senting their views in the highest quarters, and even though we may not agree with everything in the report, we commend the frankness which has led the committee to state so fairly the reasons which have led them to the conclusion at which they have arrived.

* * *

Economic Town Planning.

Mr. Ross Young's recent paper on the "Fundamental and Economic Considerations in Relation to Town Planning" was a welcome change from the usual type of town-planning paper. As a Scottish member of the institution, he naturally places the economic expansion of our industries first and the betterment of our social and communal life second, whereas most writers south of the Tweed reverse these considerations. "The science of town planning must," he says, "primarily involve the study of the evolution of towns in relation to social progress and industrial activity." It is not sufficient to confine our plans to the width and direction of roads and the number of houses per acre, but we must also consider the industries on which the occupants of the houses depend, and which provide the funds for laying-out the roads. As Mr. Harpur said in the discussion on the paper, we must know what industries are coming to the town before we can settle our plan. We must know where the railways, canals and pits are to be placed in the case of an industrial town before we can plan our streets and open spaces. The width of our roads cannot be determined until we know what traffic they are likely to carry. We must arrive at some idea of the economic requirements of the town to be planned, and the forces which will determine its future growth, before we can make provision for its expansion. Mr. Young insists that it is a blunder for town planners to concentrate the greater part of their attention on details which could be better considered at a later stage, and neglect the larger and wider issues on which further growth will hinge. The wide application of physical science to our industrial and social life tends to divert them into entirely new channels. Whereas the majority of our large industrial towns were formerly found on, or near to, our coal-fields, or on some important waterway, we now find that the introduction of other forms of power, such as oil, gas, or electricity, or the improvement in steam plant, has enabled us so to cheapen and improve our transport, and give better travelling facilities, that it has allowed many important industries to be moved from the town into the country.

It is very necessary in town planning that we should not lay out our towns with such cast-iron rigidity that there is no room for future expansion, or for development on somewhat different, and it is hoped better, lines. Many towns are dependent upon some one branch of our staple industries; but it is hardly wise for any town to "have all its eggs in one basket," for the ups and downs of trade are always felt more keenly in these towns than in those which have a greater variety of industries. The problem of special industries and their permanence is of peculiar interest at the present moment. The large centres of industry created by the demand for munitions, although generally of a somewhat temporary character, are in many cases of such vast proportions that the question of their permanence is of vital importance to the town planner. When the war is over many will no doubt disappear, as the factors which now make for usefulness will then act in a contrary manner. Their isolation from our large towns is frequently now a valuable asset; but one cannot keep large bodies of men and women herded together in temporary buildings, with few, if any, of the amenities of life, once the need for their special work has gone, and the attraction of high wages has been lost. On the other hand, the capital invested in buildings and plant is so large that there can be little doubt that every effort will be made to retain many of them for ordinary industrial purposes when peace is declared; and the assistance of town planners will then be needed to make these places healthy and well-organised communities. While Mr. Ross Young agrees that the population of this country should be housed in communal units of reasonable size, instead of in large massed formations, he is of opinion that, in the case of a number of towns within a reasonable distance of each other, a sweeping and comprehensive town plan dealing with the whole area should be prepared, after consultation with all the different authorities affected. The towns in the Clyde Valley and on Tyneside (South Lancashire and the Birmingham district might also be included) are so linked up and dependent on each other that a town plan embracing the whole of the towns in these areas is now becoming recognised not only as desirable, but necessary. Mr. Smith said Mr. Ross Young "wanted to start his town plan at Edinburgh and finish at Greenock"; and Mr. Young, in his reply, said he did. He "would have a plan of the whole industrial area, for if the plan is confined to little schemes it is site planning, and not town planning."

* * *

Motors for Municipal Work.

Another evidence of the increasing interest that is being taken in the use of motors for various kinds of municipal work was afforded by the fact that at the annual conference of the Institute of Cleansing Superintendents all of the papers dealt with one aspect or another of this question. It is true that the new president, Mr. W. Harpur, the city engineer and surveyor of Cardiff, dealt in his inaugural address with the general progress of municipal work in that city, but later in the meeting he submitted a paper dealing with the results of the use of steam tractors in cleansing work. Quoting from a report which he prepared in the year 1906, Mr. Harpur stated that the cost of collecting house refuse by motor worked out at 2s. 4·25d. per ton, and by horse-wagons at 1s. 8·81d. per ton. These figures relate to a time ten years ago, but the experience of the intervening years has not enabled engineers to form a more favourable opinion in regard to the suitability of motor vehicles for this particular type of work. If the ultimate destination of the refuse is at a long distance from the points of collection, it may be an economical proposition to collect by means of horse-drawn wagons and subsequently to transfer the material into motor lorries for conveyance to the tip. But the constant stopping and restarting which are inherent in the ordinary work of collection render motor vehicles unsuitable for this purpose. Mr. Terry, of Nottingham, read a paper in which he pointed out the peculiar advantages of electric vehicles in the removal of house refuse if motors of any type are to be used. He alluded to only two disadvantages—namely, the high capital cost and the low speed. The former is considerably discounted by the fact that electric vehicles claim a long life and low cost of maintenance. Moreover, for the actual work of collection it is open to question whether low speed is in itself a disadvantage. The real question seems to be as to how the working cost per ton using electric vehicles compares with the cost when horse traction is used. The result of such a comparison appears to be favourable to the electric vehicle, a type the popularity of which seems to be considerably on the increase. Mr. Greig, of Glasgow, dealt with the results obtained in street cleansing by motors. This is a class of work for which motor vehicles are peculiarly suitable, for it involves heavy loads, long journeys and few stoppages. It is not surprising therefore to find that

the unanimous opinion of those who have used motor-sweeping machines is that they are, from an economical point of view, a pronounced success. Nevertheless, if the greatest efficiency is to be obtained, they require careful and skilled handling, and Mr. Greig's suggestion that drivers and foremen should receive instruction from motor experts is well worthy of consideration. Mr. James Bee, of Blackpool, also contributed an interesting paper on street watering with electric vehicles. The whole series of papers is of the utmost value to the increasing number of municipal engineers who are being called upon to consider the question of the substitution of motor for horse haulage; and, taken in conjunction with the report of the efficiency division of the Chicago Civil Service Commission, to which we called attention in our issue of October 1st last, affords practically complete information on the subject.

* * *

Middlesex Roads. In his latest annual report some extracts from which appeared in our issue of last week Mr H. T. Wakelam, the county engineer of Middlesex, mentions that the paved tracks of the light railways constructed and leased by the county council have proved during the present crisis of exceedingly great benefit to the road traffic of the county, and especially so where the tracks were laid on roads which have haunches constructed with ordinary water-bound metalling. These haunches are now, in many instances, in an extremely bad condition, and were it not for the tracks in question an absolute necessity would have arisen within the past year for some permanent form of surfacing to take the place of the water-bound metalling referred to. New surfacings of the kind would, necessarily, have been both costly and difficult to obtain. It is therefore worthy of note that in this time of stress and trouble the light railway tracks have been of the utmost value, financially and otherwise, to the county, apart from the convenience they afford the public in the way of quick transit from one centre to another. The tracks have withstood the stress of the heavy transport traffic extraordinarily well, and are standing up well under the heavy loads they are constantly carrying. Some of the creosoted wood paving of the permanent way of the tracks has been down as long as from thirteen to fourteen years, and still presents a remarkably good surface.

Mr. Wakelam also draws attention to the advantages gained, from a point of view of general convenience, during the abnormal conditions prevailing, from the resurfacing work carried out about three years ago in asphaltic macadam along the Bath and Staines roads. These roads have not only been subjected to the heavy stress of transport traffic during the war, but also to the trying winter we have passed through, when snowstorms and bad weather made road maintenance very difficult. During the bad weather at the beginning of 1916 both the Bath and Staines roads were found, owing to their impervious surfaces, the least difficult to clear of snow, &c., and by reason of this the important transport traffic already referred to was much facilitated. Another point in favour of the work carried out in asphaltic macadam has been in the direction of its advantages during the time ordinary road materials have been so scarce and difficult to get.

* * *

The London Tramways Deficit. The supporters on the one hand, and the critics on the other, of the London tramway undertaking are supplied with plenty of material for the promotion of their particular views in the report presented to the London County Council on Tuesday last, showing a deficiency of £73,795 on the accounts for the past year. The Finance Committee state that the nett capital expenditure in 1915-16 amounted to £200,854, and the total debt incurred up to March 31, 1916, was £13,930,660, including £329,083 in respect of stock issue expenses, and £85,000 advanced from the Consolidated Loans Fund at March 31, 1916, on account of 1916-17. The debt outstanding on March 31, 1916, was £9,701,208. The total revenue receipts for the year amounted to £2,339,291 (comparable with £2,399,846 in 1914-15), and the surplus on working was £655,631. The report concludes with the statement that the position of the tramways undertaking causes the Finance Committee no little anxiety, and that "unless improvement is quickly manifested and equilibrium restored between receipts and expenditure the undertaking may, for the first time in its history, involve a charge upon the rates." It is welcome to receive this last assurance, as there is a very prevalent impression among uninformed people in London that the tramways are more or less a permanent charge upon the rates of the Metropolis. As to the chief causes of the deficit we have not far to seek. An ill-advised strike of the employees was responsible for a loss of income of something like £100,000, and the war service allowance for ex-tramway employees has saddled the undertaking with a further sum of £122,000. It is complained that this latter item should not be charged to the tramways account, but it might equally be contended that the war service allowance to teachers ought not to be charged to the reduction account. Clearly these charges must be properly classified, and the logical view is to allocate them departmentally. Though the condition of the undertaking may give rise quite reasonably to anxiety, there is no necessity for despairing of the future. It has so far weathered the storm of a number of quite exceptional difficulties, and with the advent of better times there is every reason to hope it will enter upon a period of normal prosperity.

* * *

Premium Pupils. An interesting discussion took place at a recent meeting of the Halifax Town Council on a proposal to allow the town clerk, the borough treasurer, and the gasworks manager to have premium articled pupils, limited to two each at any one time. The proposal did not include the borough engineer, as that official is already authorised to take pupils, but we call attention to the discussion because the views expressed by the various members illustrate clearly the divergence of opinion which exists in the minds of members of local authorities in regard to this important question. On the one hand, it was said that for municipal appointments all comers should have an equal chance, and that the maintenance of the pupilage system gives an unfair advantage to those young men whose parents can afford to pay the necessary premium. On the other hand, it was pointed out that unless the supply of pupils is maintained there will necessarily be in the future a shortage of properly qualified candidates for important positions of a technical character. For our part we are clear that in the case of engineering appointments involving the administration of vast sums of public money it is in the public interest that those who are appointed should have received a proper professional training. Whether this can be best obtained by pupilage in an office, by attendance at a college, or by a judicious combination of both, may be open to discussion. We have on former occasions expressed our opinion on this point, and we need here only say that the filling of professional appointments by those who have merely gleaned a smattering of technical knowledge while performing clerical duties in an engineer's office, is certainly contrary to the best interests of local authorities and the ratepayers whom they represent.

The Results Obtained in Street Cleansing by Motors.*

By W. GREIG, Cleansing Superintendent, Glasgow.

I propose giving a brief *resumé* of our experience in Glasgow in the realm of street sweeping by means of mechanically propelled vehicles, the motive power of which is derived from the internal combustion engine, the fuel used being petrol.

I have not the slightest doubt that some of the conclusions we in Glasgow have arrived at in this comparatively new sphere of our work will be challenged by my friends here; indeed, I hope it may be so, for only by such means can we hope to gain knowledge, and my object is as much to elicit fresh ideas and information for the benefit of us all as to endeavour to convey to you some results of the large and varied experience the Glasgow Cleansing Department has had in this connection.

In laying claim to this large and varied experience it is hardly necessary for me to remind you of Glasgow's population, size and extent. Our city area is 30 sq. miles; the streets extend to 476 miles; and our inhabitants number 1,075,000.

The streets are principally laid with whin or granite setts, comparatively few being smooth paved. There are, of course, a number of macadam roads

Our first motor street-sweeping machine started work on September 11, 1912, and since then the number has been increased from time to time, until at present the department owns twelve motor street-sweeping machines—viz.: 6 18-h.p. by the Lacre Motor Company, Letchworth; 5 12-h.p. by M. Laffly, Boulogne-sur-Seine; 1 16-18-h.p. by Thomas Green & Sons, Leeds.

All the machines are driven by live axle, with the exception of the "Lacre" vehicles, which are chain-driven. All are fitted with rubber tyres. The length of the brushes varies from 6 ft. to 7 ft. 2 in., and the actual width swept ranges from 4 ft. 10½ in. to 5 ft. 4½ in. In the case of the Laffly machines the brush is all in one piece (7 ft. 2 in. in length), but in the other types it is made up of segments measuring approximately 16 in. in length. With one exception the machines are equipped with water tanks having a capacity of 80 to 150 gallons, from which the water is sprayed under pressure by means of atomisers. The vehicles are also fitted with "cabs" and adjustable wind-screens to protect the driver during inclement weather—an advantage which he no doubt appreciates when contrasting his lot with that of his colleague on the horse-driven machine. These are the chief features of our motor-sweepers, but I shall be pleased to supply anyone interested with a full specification should he desire it.

When the introduction of mechanically driven vehicles in place of horse-drawn vehicles was under consideration in Glasgow, the two points which had to be carefully borne in mind were our old hard-worked friends "economy" and "efficiency." These are vital factors—not only in cleansing work, but in all work.

As regards economy, it is recognised that the most profitable work for petrol-driven commercial vehicles is that which involves (1) heavy loads; (2) long journeys; and (3) few stoppages—as short as possible. In cleansing work, motor street-sweeping machines approach most nearly to these ideal conditions, and this, I think, has been demonstrated in every town which has introduced such machines.

The journeys are long, the stoppages few and short, whilst the load—the area swept in this case—is greater than in horse-drawn machines, and this should be the greatest possible consistent with speedy working, taking into consideration traffic conditions, running costs, and tear and wear of machines. It is not surprising, therefore, to find that the unanimous opinion of those who have used motor sweeping machines is that they are, from an economical point of view, a pronounced success. I am able to show, from the tabulated statements submitted with this paper, that the results obtained in Glasgow as compared with horse-drawn vehicles are all in favour of mechanical sweeping.

As to efficiency, the general consensus of opinion is that motor street-sweeping machines do the work of sweeping quite as well—possibly rather better than horse-driven sweeping machines. There may be superintendents and others who hold the view that horse-drawn machines do the work better, but I am of opinion they are in the minority. I am afraid that those who maintain that the motor street-sweeping machine does not perform its work efficiently are swayed to some extent by prejudice. I am assuming, of course, that the motor sweeper is operating under good working conditions. It is the case that the motor sweeping machine, when the brushes are nearly worn out, may not give as good results during the last half shift when the brush is in reality too short for satisfactory work. This is due to the fact that the first half shift of the last day's work has worn the brush to that point. It must be borne in mind that a motor sweeper travelling over six miles per hour wears out the brush in a much shorter time than a horse-drawn machine, and therefore a half shift in a motor sweeper makes an appreciable difference in a brush, whereas in a horse-drawn machine it is insignificant.

Working Costs of Motor Sweeping Machines for year ended 31st May, 1916.

Time—Working days		1,895
,, Actually sweeping, hours		14,846
,, Average number of hours sweeping per day		7·83
Total distance travelled to and from sweeping points		8,330
Mileage swept	Total	89,393
,, ,, per day	Average	47·17
,, ,, per hour	Average	6·02
Area swept, sq. yds.	Total	275,814,954
,, ,, ,,	Daily average	145,530
,, ,, ,,	Per hour	18,578
Motor spirit :—		
Total quantity, galls.		9,811
Total cost		£585 15 5
Miles per gallon, including travelling		9·96
,, ,, less travelling		9·11
Cost per mile, including travelling		1·44d.
,, ,, less travelling		1·57d.
Drivers' wages		£599 11 11
Repairs, cleaning and supervision		505 5 4
Motor spirit		585 15 5
Oil, grease and sundries		90 5 0
Brushes, including cost of fitting		813 5 8
Tyres, upkeep of		135 19 10
Insurance		76 12 6
Depreciation (20 per cent per annum)		694 4 0
		£3,500 19 8
Cost per 1,000 square yards swept, including repairs		3·05d.
Cost of brushes per 1,000 square yards swept, including repairs		·71d.
Saving compared with horse-drawn machine		£1,321 12 3

This is one of the few points in which the actual conditions suit the horse-drawn machine better than its rival and enable it to show in a favourable light—it sweeps well to the end of the life of the brush. But this adverse criticism of the motor vehicle only applies to machines working during the night, or at a considerable distance from the depot during the day. If working during the day within reasonable distance from the depot, the worn-out brush can be taken out and replaced. With machines working during the night, or at a considerable distance from the depot during the day, the unsatisfactory work can be reduced to a minimum by working the machines in teams of three or four, utilising the machine with the shortest brush to perform the first stroke throughout the sweeping operations.

A special feature of the motor sweeper which is

* Paper read at the annual conference of the Institute of Cleansing superintendents, held at Cardiff.

worthy of mention is its water tank and atomiser. In sweeping operations during dry weather it was formerly necessary to water the streets in advance of the machine. By the introduction of the water-spraying apparatus on the motor sweeper the time of the horse and man with the watering cart is saved. The state of the surface of the streets is frequently such that smooth-paved streets require watering, whereas streets laid with setts do not need damping. Under these conditions the atomiser shows to advantage. It also frequently happens in this variable climate of ours that in the middle of the advance watering operations one or more good showers cause the water cart to look ridiculous, and the work of the horse is rendered superfluous so far as the area watered has not been swept before the rain came on. How favourably the atomiser shows up under such circumstances is obvious. The only difficulty experienced with the spraying apparatus is that it chokes readily with glut, or fine dust or grit, and consequently requires constant inspection and cleaning. In fact, in Glasgow and, I understand, some other places, it has been necessary to increase the mesh to meet this objection, at the sacrifice of extra time lost in filling the tank more frequently.

Another advantage of considerable value to be obtained from the use of motor sweeping machines may be mentioned here. It is the working of these machines in double shifts. In large towns, where much sweeping falls to be done, and traffic and other conditions permit of its being partly performed during the day, the saving to be effected is too obvious to require further comment. That is, of course, provided always that day cleansing is approved. This is, I am aware, a matter of opinion, but in any case it is outside the scope of this paper.

RUNNING COSTS

In submitting statistics of the running costs of our motor sweeping machines, I would like to say that I do so without intending to set up a comparison with the results obtained in other cities and towns, whether more economical or otherwise. Speaking generally, comparisons of costs between one place and another are fruitful of error and misunderstanding, and the reasons are not far to seek. It would be difficult to find two industrial centres in which there exists anything like equality of conditions. The volume of traffic and the proportion of area to population differs almost everywhere. Then again, the topographical and climatic conditions and the nature of the surface of the streets—which in conjunction with the extent of traffic largely determines the cost of street cleansing—are generally dissimilar.

It is only to be expected that better results will be obtained in towns where good sweeping conditions generally exist than in places not so well favoured. In Glasgow the density of population, the vastness of industry, and the great volume of traffic, render the conditions undoubtedly severe. The material to be removed is greater than in the same mileage of streets with equally good surfaces, but under different conditions as to population, industry and traffic. The state of the dirt and its adherence to the surface is determined by the amount of traffic over it, and the prevailing weather conditions. I should think that these drawbacks are more in evidence in Glasgow than in most towns. The condition of the surface—paved or otherwise—is a factor of great importance. Fortunately, in Glasgow there is no reason for complaint in this connection. A vast improvement has been effected during the last dozen years, and the condition generally is very good. The continued laying of smooth impervious paving and the gradual abolition of macadamising is assisting greatly in this direction. It is therefore evident that inferences drawn from comparisons between places that are not comparable cannot have any real value.

WORK IN ENGLISH TOWNS

While speaking of comparing results in different places, it may be pointed out that the amount of sweeping done by a horse-drawn machine in Glasgow is approximately seventeen miles of track. In English towns this length is never, to my knowledge, reached, and is generally given as about twelve miles. The effect of this circumstance on comparisons is clear. Motor sweepers may be doing exactly the same amount of work in two different towns, and yet in the one be doing the work of three horses, and in the other the work of four. A bald statement that a motor sweeper is doing the work of so many horses in "A," and displacing so many in "B," is, it will be agreed, valueless for the purposes of comparison.

It follows that the standard of horses engaged in street sweeping has a distinctive bearing on the question of comparative cost as applicable to mechanical haulage. In this connection I am of opinion that in Scottish towns the greater amount of work performed can only be explained by the fact that horses of the Clydesdale breed are employed as against those of the "Shire" type in England.

I had the privilege of visiting an English town quite recently, and as the result of personal observation of horses engaged at cleansing work, I have no hesitation in stating that our horses overtake from 50 to 75 per cent more work than in the town referred to.

In some towns in England it is claimed that a motor sweeping machine performs the work of three horse-drawn vehicles, and in other places the machines are said to displace six to seven horses. We have not yet attained the latter displacement, but as near as possible one motor sweeper in Glasgow is overtaking the work of three horses. While this is satisfactory so far as it goes, and is undoubtedly more economical than horse-drawn vehicles, one must not, in comparing mechanical haulage with that of horses, run away with the idea that all the advantages are on the side of the first-mentioned. The bulk of them do lie with it and give it claims which fully justify its preferment, but there is something to be said for our tried and faithful servant the horse—still holding its own in many branches of cleansing and other work. I refer particularly to its mobility, and this, along with reliability, constitute the most important points in its favour. During climatic changes, or for other reasons, it can be transferred on the shortest notice to do any class of work of a haulage nature.

I will illustrate my meaning. Suppose a severe snowstorm in winter takes place, every available horse has been taken from refuse removal and other work and is fully occupied in the removal of snow. Immediately the snow has been removed frost sets in, rendering street sweeping of little avail on account of the hard surface. In that event sweeping may be almost entirely suspended, and the horses put to forward the work which had been stopped through the snowstorm. There are other periods of the year when this interchangeability would prove extremely advantageous and economical. A motor sweeper can only do the sweeping. This is a point of paramount importance to smaller towns; even in larger towns where the major part of the sweeping, say 80 per cent, is performed by motor vehicles, it may still be expedient to reserve the remainder for horse-drawn machines.

IMPORTANT POINTS.

To get the best work out of a motor sweeping machine it should be worked on long stretches, with as few turns as possible. This entails the working in teams of three or four machines, according to the width of streets to be swept, in order to allow the work of gathering and removal to proceed expeditiously. Another advantage is an appreciable saving in front tyres. The turnings are invariably in the shortest radius, and when frequent the grinding action is very detrimental to the tyres.

It is essential that the mechanical parts of the machine should be kept in the best of order. An annual overhaul, even if no fault discloses itself, is to be recommended, and I would therefore advocate that there should be at least one spare machine in a fleet of ten to twelve machines, provided such a number can be profitably employed.

The drivers should be selected with the greatest discrimination with regard to skill and care and interest in their work. During war time this is difficult in fact, impossible and in Glasgow the results are reflected in the loss of working days and the repairs bill. An alert and intelligent foreman can assist the work by exercising close supervision, planning of work and judgment of conditions from night to night. Weather conditions vary greatly, thus quickly affecting the state of the surface of the streets. This in turn determines the pressure of the brush on which, to a large extent, the petrol consumpt, the life of the brush, and other wear and tear of the machine depends. A careless foreman or unobservant driver would negligently keep the brush at the same pressure on the surface of a street that is hard and dry, as for one of a pasty nature. Regulation of

pressure is absolutely necessary in the interests of economy.

At this juncture I would offer the suggestion that in normal times considerable advantage would be derived from a series of lectures and demonstrations by motor experts to drivers and foremen. In fact, the art of driving and the knowledge how to effect simple running repairs should form part of a foreman's training, who, as a rule, is usually more conversant with the care and treatment of horses. Such lectures and demonstrations would prove beneficial to both employee and employer, and be the means of instilling into the former a desire to take a healthy and intelligent interest in motor vehicles, and grasp how to make the wheels go round in the sweetest and most economical manner.

A WORD TO MANUFACTURERS.

Perhaps a word to motor manufacturers may not be amiss. They should not rest on their oars under any misapprehension that their product is the last word in sweeping machines. They should, and I believe will, devote their closest efforts to bring the machine to a greater degree of perfection, particularly with regard to reliability. The unreliability of the machines may be due to one or more of the following reasons: (1) defective design; (2) bad workmanship or material; (3) rough usage; (4) negligence in attention to repairs more especially of the "stitch in time saves nine" character. The first lies with the experts and there is no excuse for the second. With regard to the third and fourth these are the concern of the users, but at the same time the makers can help their customers very materially in these respects, and it is to them I would direct their special attention. Rough usage and careless handling are always worrying all users of motor vehicles, and improvements in design with a view to greater stability and to making the machines "fool-proof" as nearly as possible are greatly to be desired. Repairs and breakdown at awkward times are sources of much annoyance and inconvenience. Improvements in design making for greater facility of continual inspection, and speed and simplicity in carrying out the necessary repairs, would save much loss of time, not to mention temper, and would approach the ideal which cleansing superintendents are striving for in this as in every other department of their work.

In conclusion, I may say that I feel honoured in being asked to appear before you and give you, as a corporate body, the benefit of our experience in Glasgow in regard to this branch of mechanical enterprise. I quite realise that it is only by making ourselves helpful to one another—even at the risk of well merited criticism—that we can become more serviceable to our respective corporations. To be harnessed with the responsibility of cleansing great cities and towns must of necessity make cleansing superintendents ever on the alert for ideas suggestive of improvement, in order that we may make steady and continuous progress in our important sphere of municipal work. To a great extent we are responsible for the health and comfort of the citizens, and in our effort to impart sweetness and attractiveness to our streets, I make bold to say that, speaking generally, our army of ratepayers are receiving better value for their money than they have ever known. For much of our advancement we have in no small measure to thank our connection with the Institute of Cleansing Superintendents, and I am of opinion that, in view of the rapid progress of inventive genius, it would be well if corporations were more generous in affording to members of committee and officials greater opportunity of seeing for themselves what is being done in the principal cities. The expenditure involved would in all probability be more than repaid by the introduction of methods leading to economy and efficiency, and at the same time assist even a cleansing superintendent to excel in a calling which, to a certain extent, is shrouded in an obscurity which never darkens the portals of less important but more attractive branches of municipal work.

London Arterial Roads. With reference to the request made to Mr. Asquith and Mr. Walter Long to receive this week a deputation from the Second Main Conference on Arterial Roads in Greater London, in support of resolutions passed at that conference on May 19th, it is understood that the Prime Minister will not be able to receive the deputation, but that Mr. Walter Long will probably do so. No date has yet been fixed for the event.

ALLOWANCES TO OFFICIALS ON SERVICE.

A LYME REGIS DISCUSSION.

At the last meeting of the Lyme Regis Town Council (the *Bridport News* reports) the town clerk said that consideration had to be given as to whether the grant of £25 per annum made to Mr. F. H. McDonnell, the borough surveyor, while serving in the Army should be continued in view of the Local Government (Emergency Provisions) Act, 1916, which provided that no excessive payment could be made without the sanction of the Local Government Board. The grant to Mr. McDonnell would no doubt come within this category, as his pay as a captain in the Royal Engineers would most probably exceed his civil remuneration as an officer of the council. Therefore, if they wished to continue the payment they must obtain the sanction of the board, and he pointed out that the local authority need not reduce a payment so made where in a case like the present an officer, by getting promotion, received higher pay, but the approval of the board was necessary just the same.

Replying to Councillor Budgett, the town clerk said Mr. McDonnell joined the Engineers as a subaltern. He did not know what the pay was, but he thought the council estimated it at about £80 when making the grant of £25. As to the pay as a captain, he had enquired, but had been unable to obtain the information. It was probably something like £200 a year.

Councillor Long said at the time the grant was made the council considered they were making up Mr. McDonnell's army pay to the same amount as he was previously receiving as their surveyor, and in view of the fact that this point no longer arose, as the officer was now captain and his pay consequently in excess of his civil remuneration, he considered the council should take a similar course to what they had done with their other employees. He moved that the grant be discontinued.

Councillor Camplin, seconding, said there could not be the slightest doubt in anyone's mind that the grant was made to make up the civil remuneration. As this necessity had ceased they should put him on the same footing as the other employees who were on service, and he reminded the council that in one case a reduction had already been made. Councillor Budgett thought it was hardly fair to do away with the grant. They agreed to give Mr. McDonnell the £25 a year while on service during the war, and it was a contract, even if it was not a legal one, which they ought not to repudiate. The council must remember that when an officer secured promotion, and, consequently, increased pay, it was because his services merited it.

Councillor Wiscombe supported this view, and pointed out that it was no encouragement for a man to get promotion to take away the grant. He felt they were bound in the matter.

Councillor Budgett moved as an amendment that the council apply to the Local Government Board for sanction to continue the grant.

Councillor Wiscombe seconded. Councillor Long, replying on the debate, contended that the grant was made owing to Mr. McDonnell's army pay not being up to his civil remuneration. He claimed that if the grant was continued it was different treatment to what they had meted out to other employees. On a division, four votes were given for the amendment.

The Mayor said he would give his vote for the amendment and let the Local Government Board decide.

Motor Fire Engines for the London Fire Brigade.—The London County Council Fire Brigade Committee have decided to purchase two motor fire engines from Leyland Motors (1914), Limited, at £887 each. At the same time they report that they have sold two second-hand motor engines for £500 each, and two at £400 apiece.

Restrictions on Building Work.—Mr. Montagu, the Minister of Munitions, announces that as from yesterday no one may carry on any building work without a licence, unless the cost of the work is less than £500 and no constructional steel is involved. "Building work" includes alterations, repairs, decorations and demolitions, also the construction of railroads, docks, harbours, canals, embankments, bridges, tunnels and piers. Government contracts and local authorities' contracts sanctioned by the Government are exempt. Applications for licences should be addressed to the general secretary, Ministry of Munitions, 6 Whitehall-gardens, S.W.

Improvements of Highways to Meet Modern Conditions of Traffic.*

By W. H. SCHOFIELD, ASSOC.M.INST.C.E., County Surveyor, Lancashire.

It would, at the first glance, appear somewhat inopportune to be discussing road improvements at this time when local authorities are being pressed both by the Government and the local ratepayer to reduce all public expenditure to the lowest possible limit.

In Lancashire, however, and no doubt the same can be said of other counties in the kingdom, the heavy mechanically propelled traffic has considerably increased on many of the main roads, in spite of, or perhaps it would be almost more correct to say because of, the war, and the problem of road improvement is as urgent as ever.

The railways being now under Government control are being extensively used for naval and military purposes, with the result that manufacturers find increasing difficulty in obtaining delivery by the railway companies of raw materials required by them, and in the distribution of the manufactured goods among their customers.

To get over this difficulty a very considerable number of commercial firms have purchased and are running their own motor wagons instead of sending their goods by rail and in consequence the number of heavy mechanically propelled vehicles using some of the roads has increased by as much as 60 per cent. in excess of that in existence before the commencement of the war, and in some exceptional cases considerably more.

The main problem in this county is therefore that of meeting and providing for the improvement of the roads in such a manner as to render them capable of carrying the heavy weights at the high speeds which are allowed by the present law, and which, to make matters worse, are constantly being exceeded.

The considerable volume of local traffic which existed previously to the adoption of mechanical transport to a certain extent compelled the boroughs and larger urban districts to build their principal roads with substantial foundations, and to surface with more permanent materials, and these areas were consequently in a much better position to cope with the new form of traffic which has come on to them during the past five or six years rather than the intervening lengths through the rural districts which, although they were generally sufficiently strong to reasonably carry the horse-drawn traffic, were often insufficiently drained, and void of any substantial foundation.

Many of these rural roads, although forming the only means of communication by road between large towns, formerly only carried a traffic of a light type, and were well maintained as water-bound macadam surfaces, to which no very serious damage was done by the addition of a moderate number of light motor cars, particularly if the macadam were frequently tar-sprayed, the main cause of complaint unless tar-spray was used being that of the dust raised by the quick-moving vehicles.

The conditions now existing are, however, very different, as the rural roads are having to carry weights far in excess of those conveyed along them at any previous period and at a much higher rate of speed, in fact the speed of heavy motor vehicles being restricted in populous areas by the exigencies of the local traffic, and the fact that the police supervision is generally able to be more effectively applied, is often increased in the rural areas beyond that allowed by law, to make up the average running.

The rural roads for this reason, while being less able to bear the traffic owing to weak construction, are often more sorely tried than town streets.

The most pressing need for improvement in this county is therefore the strengthening of the foundations, improved surface and subsoil drainage, and the better surfacing of the roads in the rural areas.

The following examples show the alteration in the character and volume of traffic on roads of this class.

Statistics taken on the Liverpool and Manchester road in July, 1911, show that there were 1,104 mechanically propelled vehicles and 1,591 horse-drawn vehicles in seven days, as compared with 2,955 mechanically propelled and 1,303 horse-drawn vehicles in seven days in January, 1916. Of these in July, 1911, heavy motor wagons numbered 155, and in January, 1916, numbered 1,694 for the seven days.

The comparison of weights for the same periods is as follows:

July, 1911.

Weight of mechanically propelled vehicles ...	2,236	tons
„ horse drawn vehicles	1,677	„
Total for seven days ...	3,913	„

January, 1916.

Weight of mechanically propelled vehicles ...	15,715	tons
„ horse-drawn vehicles	1,502	„
Total for seven days ...	17,217	„

PRESTON AND BLACKPOOL ROAD.

		No.	Weight.	
Feb. 1911	Mechanically propelled ...	584	1,586	tons
	Horse drawn	738	746	„
	Total for seven days ...	1,322	2,332	„
Feb. 1916	Mechanically propelled ...	1,498	3,502	tons
	Horse drawn	565	629	„
	Total for seven days ...	2,063	4,131	„

MANCHESTER ROAD, RAMSBOTTOM.

Feb. 1911	Mechanically propelled ...	285	1,340	tons
	Horse drawn ...	1,382	1,685	„
	Total for seven days ...	1,667	3,025	„
Jan. 1916	Mechanically propelled ...	1,373	6,461	tons
	Horse drawn	854	1,171	„
	Total for seven days ...	2,227	7,632	„

The total number of heavy motor lorries and trailers for seven days in February, 1911, included in the above figures for Ramsbottom was 122, compared with 913 in January, 1916.

The foregoing weights are calculated on the assumed weights set out in the first column of the statistics of traffic (summary form) issued by the Road Board, and which the writer submits, at any rate so far as the commercial traffic of Lancashire is concerned, are substantially underestimated.

These examples of the comparatively recent increase of traffic on roads lying outside the populous areas can be multiplied many times, but the foregoing will probably be sufficient for the purpose.

In the case of the Preston and Blackpool road, the writer desires to point out that the winter traffic statistics only are given. In the summer the figures for mechanically propelled vehicles, particularly those of the light type, are more than trebled.

Although the recent addition to the number of heavy commercial motors using the roads in this county may be due at the present moment to restricted railway facilities, it is doubtful whether any considerable portion of the traffic will be restored to its original channel when times become normal, and if, on the other hand, the rate of increase during the past five years is maintained in the future, it will become imperative to adopt a still more substantial and expensive form of improvement and reconstruction of rural main roads than has so far been the general practice.

In addition to the heavy commercial motor, the great increase in the numbers of heavy motor chars-a-bancs, and motor 'buses which have come into use chiefly for pleasure parties, particularly in the neighbourhood of the seaside towns, such as Blackpool and Southport, are the cause of a substantial amount of damage to the water-bound rural roads.

Unfortunately, one has to admit that the reconstruction and improvement of roads generally had not even before the war kept pace with the development of the mechanically propelled vehicles, and under the present conditions of reduced expenditure by county and local authorities, and the loss of Road

* Paper submitted at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

Board grants, it seems very probable that this work will fall still further behind.

SURVEYORS' DIFFICULTIES.

In addition to the question of finance, surveyors are now faced with the impossibility of obtaining a sufficient supply of either materials or labour for any extensive works of reconstruction, and even for the maintenance of existing conditions.

In normal times the financial problem provides the greatest difficulty, particularly in county and rural areas, which generally have a very long mileage of roads requiring reconstruction to meet the needs of the new form of traffic, and a limited purse out of which to defray the cost.

In this county there are 641 miles of main roads, of which 333 miles are in urban and 308 miles in rural areas.

The rural main roads, with a few exceptions (chiefly those which have been reconstructed of recent date), are without any substantial foundations, and consist of an accumulation of broken stone varying from 6 in. to 12 in. in thickness, laid on the natural subsoil.

The same remark applies to a considerable mileage of the main roads in the outlying portions of urban districts.

To reconstruct, say, 350 miles of these roads with a hand-pitched gritstone rubble foundation, and surfaced with a 4-in. consolidated coat of tar-macadam, including a 5-in. by 12-in. gritstone-edging and improved drainage, would cost approximately £1,848,000, on which the repayment over a period of ten years, with interest at 5 per cent, would amount to £240,240 per annum, or an annual charge of £686 per mile, to which would have to be added some allowance for maintenance, particularly towards the end of the period.

Although the provision of substantial foundations therefore is theoretically desirable, the financial difficulty is so great as to render it almost impossible of attainment by authorities having a large mileage of roads to reconstruct, in any reasonable period of time.

It has, so far, been found possible in this county to meet the needs of modern traffic on the rural main roads by strengthening the road crust by the addition of a coat of tar-macadam.

The practice has been, except in special cases where the natural subsoil is bad, and reconstruction is absolutely necessary, to strengthen the haunches of the road by adding a width of 2 ft. to 3 ft. of 9-in. hand-pitched gritstone rubble, on a 3-in. consolidated bed of engine ashes, and by increasing the thickness of the existing crust by the addition of a 4-in. or 4½-in. consolidated coat of tar-macadam.

The average cost of this work for an 8-yds. carriageway amounts in this county to approximately £3,200 per mile.

Even this method of strengthening taken over a period of either seven or ten years makes a very heavy addition to previous maintenance charges.

In the southern half of the county most of the urban roads carry a much heavier commercial traffic, as they provide the means of communication between twelve of the eighteen large county boroughs situate within the geographical county, varying in distance from 1 mile to 20 miles apart, and of fifteen out of eighteen non-county boroughs.

In this area the main roads were a few years ago generally paved with local millstone grit setts, but this type of surfacing was found to be quite insufficient to carry the heavy motor-wagon traffic, particularly those with steel tyres, and the policy of substituting granite sett paving on a concrete foundation has been adopted as being the most economical method in the long run.

This class of paving also provides a much improved surface for the light motor vehicle.

The cost of granite paving, either with 4-in. by 5-in. setts of 4½ cubes on a 6 to 1 Portland cement-concrete foundation, 6 in. in thickness, averaged in this county previous to the war 15s. per super. yard.

The writer is of the opinion that where the service of heavy mechanically propelled vehicles, whether motor 'bus or commercial wagon, is such as to necessitate the provision of new foundations, it will generally prove more economical to adopt concrete foundations and granite or wood paving.

The writer has, like most other surveyors, experimented with various materials for road surfacing. As, however, so much information has been already supplied in previous papers with regard to these he does not propose to repeat it. In the writer's experience the most successful material for surfacing rural main roads at a reasonable cost has undoubtedly been tarred iron-slag macadam.

This material is fortunately obtainable within the county at a moderate price, and so far there have been no failures of any extent. Lengths which have now been laid for seven years have required no repairs except tar-spraying in alternate years, and are still in good condition.

Tar-grouted granite-macadam was extensively laid some five or six years ago with varying degrees of success or failure, but this method has been practically abandoned in favour of tar-macadam, partly because the latter method is substantially cheaper in its first cost, and partly because the climatic conditions of this county are usually such as to limit the successful employment of tar-grouted macadam to a very short period during the summer months.

Various lengths of granite-macadam coated with tar have been laid, but these have not by any means proved uniformly successful.

"Durax" paving has also been laid on some of the more heavily trafficked roads, but the difference in cost per super. yard between that and dressed cubes or setts is, in the writer's opinion, not sufficient to make its general adoption economical, especially if the shorter life of "Durax" paving is taken into account.

WIDENINGS.

The widening and straightening of the existing main roads is almost as pressing as the improvement of surfaces if a safe passage is to be provided for the mechanically propelled vehicles of the present day, particularly of the motor char-a-banc, or rubber-tyred commercial motor wagon types.

In the writer's experience these vehicles, which are allowed by law to be used up to 7 ft. in width, and an unlimited length, are usually driven at a speed much in excess of the legalised speed limit, and a greater width of carriageway is therefore required than formerly, if accidents are to be prevented.

The old well-known rule of the provision of a width of 8 ft. as giving ample space for each line of traffic has become insufficient to meet the present-day requirements, and in the writer's opinion multiples of 10 ft. are at least now desirable for safety, with considerable further widening at sharp curves.

The construction of short diversions will often prove a much more satisfactory manner of improvement than the widening of two or three contiguous curves, as, although the first cost may be substantially greater, the saving in future maintenance will generally be sufficient to recoup the extra expenditure in a few years' time.

The widening and improvement of the junctions of roads is one of the most pressing needs of the times, particularly in rural areas, where the speed of the modern vehicle on the main routes is usually unrestricted either by the exigencies of other traffic or the attentions of the local police constable.

If, however, the widening, straightening and improvement of curves and road junctions is only to result in a still further increase of the present excessive speeds, it is doubtful whether the desired purpose will be attained, but there is no question that the maintenance charges will be increased rather than diminished.

The Metropolitan Paving Committee.—A report submitted to a recent meeting of the General Purposes Committee of Holborn Borough Council stated that the Westminster City Council had decided not to appoint a representative upon the Metropolitan Paving Committee this year, as they were of opinion that, notwithstanding its usefulness in the past, it was desirable in the interests of economy that the committee should now be discontinued. The Holborn Committee expressed regret at this decision, as in their opinion the committee had served and would continue to serve a very useful purpose. There are nine Metropolitan Paving Authorities, including the City Corporation, represented upon the committee, and the expenditure, which in normal times amounted to about £100 per annum, is divided among them rateably. During the war the expenditure has been reduced to about one-fifth of this amount and this small saving should not be allowed to terminate the committee's usefulness. On the recommendation of the committee it was agreed that a communication should be addressed to the Westminster City Council asking them to reconsider their decision.

Institute of Cleansing Superintendents.

ANNUAL CONFERENCE AT CARDIFF.

Fifty authorities were represented at the nineteenth annual conference of the Institute of Cleansing Superintendents which opened on Tuesday morning at the City Hall, Cardiff, under the presidency of Mr. W. Harpur, M.INST.C.E., the city engineer. Following the transaction of a portion of the business on the agenda, including the delivery of the presidential address—the delegates, to the number of 137, were accorded an official welcome by the Lord Mayor (Councillor R. J. Smith, M.B.), who said that in municipal activity Cardiff had taken a very foremost place, and that wherever the delegates went they would see evidence of municipal and commercial enterprise. The appointment of Mr. Harpur as president of the institute would be regarded not only as a compliment to their city engineer, but also to the city. None of the officials had a higher place in the regard and the affection of the corporation than their distinguished president. No corporation had ever been better served by an official than had Cardiff by Mr. Harpur. Those present at the conference, which was brought to a close yesterday afternoon, included:* Messrs. R. Adam, inspector of cleansing, Ayr, D. Allen (Woolwich), G. H. Anderson (Middlesbrough), H. C. Bascombe (Wallasey), J. Beckett (Liverpool), James Bee (Blackpool), W. J. Bosley (Southampton), F. Brockington (Worcester), F. W. Brookman (Rochdale), E. Call (Bradford), A. Cant (Tottenham), H. Cousins (Wolverhampton), T. B. Crookes (Finsbury), R. H. Crummack, deputy borough engineer, Dover, J. C. Dawes (Keighley), F. A. Dowse (Hackney), J. Duncan (Dundee), W. H. Eccles (Stockport), H. C. J. Edwards borough engineer, Lambeth, E. I. Evans, surveyor, Penarth Urban District Council, J. Gibson (Edinburgh), W. Greig (Glasgow), W. H. Hamblett (Salford), W. Harpur, city engineer, Cardiff, J. L. Haslop (Oldham), J. R. Heath, borough surveyor, Swansea, H. Hopkinson (Portsmouth), W. H. Inger, street cleansing department, Bradford, James Jackson (Birmingham), A. G. Jefferies (Hampstead), D. Kennedy (Kensington), J. Leng (Stockton-on-Tees), T. Lloyd (Preston), W. E. Lowe, engineer and surveyor, Pontypridd Urban District Council, J. Marginson (Blackburn), L. S. McKenzie, city engineer, Bristol, J. C. Pardoe, surveyor, Barry Urban District Council, J. Priestley (Sheffield), William Ross, burgh surveyor, Motherwell, F. Smith (Bolton), W. J. Steele, city engineer, Newcastle-on-Tyne, R. H. Storer (Tynemouth), J. Terry (Nottingham), S. Thornley, assistant superintendent, Leeds, H. Tillstone, borough engineer, Brighton, T. Turner (Bury), F. W. Sykes (Newcastle-on-Tyne), T. H. Whitewick (Surbiton), H. F. Wigfield (Leicester), T. J. Williams (Swansea), and R. Williamson (Manchester).

CARDIFF'S DEVELOPMENT.

Mr. HARPUR said it was his first duty upon taking the presidential chair to thank the members for placing him in the most privileged position it was within the power of the institute to confer upon any of its members. He assured them that the honour was keenly appreciated, and it would be his pleasure during his continuance in the office to promote the interests of the institute in any way he possibly could. He wished to offer the institute a hearty and sincere welcome to what he might with some excusable pride claim to be one of the most pleasant and progressive commercial cities in the kingdom, a city in which the often unpleasant, anxious, and irksome conditions of one's professional or commercial life were to some extent compensated for by the otherwise pleasant every-day surroundings.

Mr. Harpur proceeded to give some historical particulars of Cardiff from the municipal standpoint. One of the principal subjects deserving attention was, he observed, the astonishing progress which had taken place during the past century in the commerce and population of the city, and which had rendered Cardiff the metropolis of Wales. In 1811 the population of Cardiff was only 2,577; but from that time it went on steadily increasing until in 1871 it had reached 39,536. During this time the area of the municipal borough was 2,791 acres, but under the powers of the Cardiff Improvement Act of 1875, the districts of Canton, Roath and Grangetown were added to the borough, and the area thereby was increased to 8,095 acres, its present dimensions. In 1881 it was found that the population had increased to 82,761, or an addition in ten years of 43,225; but this great increase in population, largely due to the extension of the borough boundaries, was continued for some years until the population began to overflow the city boundaries, for the returns of the census for 1891 showed the population to have increased by 46,088 in the preceding ten years, the returns for 1891 being 128,849, or an increase in the ten years of 55·7

MR. W. HARPUR, M.INST.C.E.,
City Engineer and Surveyor of Cardiff; president of the Institute of Cleansing Superintendents.

per cent upon the population of 1881. The population of the city in 1901 was 164,333, and in 1911 it was 182,259, while it is now estimated to be 188,495.

The coal and iron trades were the mainspring of the commercial prosperity of Cardiff, and the port had achieved the distinction of being the first port in the world for the volume in tonnage of its foreign exports.

DRAINAGE.

Upon the adoption of the town council in 1849 of the Local Government Act of 1848, Cardiff started upon a period of public improvement, which had gone on ever since, and was still going on, and was telling greatly in the health, comfort and enjoyment of the people. Extensive drainage works were commenced in 1853, and from that time until the present had been continued and extended as time and necessity required.

The configuration of the site upon which the town lay was almost flat, except in the north-eastern extremity, and consequently the question of sewerage had been a difficult one. A large portion of the town was built upon a level with high-water mark of ordinary spring tides, and the sewers (which discharged into the Bristol Channel) were of necessity some depth below the surface of the ground, and consequently all the sewers, with the exception of those in the Western District, where the sewage was pumped, were tide-locked for some time before and after high-water of all ordinary and spring tides; and in order to store the sewage when the tide-valves were closed large sewers were provided which acted as storage reservoirs until the tide receded, when the contents were discharged. The evenness of the surface of the ground had also rendered the question of obtaining suitable gradients for the sewers a difficult one, some of the gradients being as slight as 1 in 2,000. Notwithstanding these difficulties, however, Cardiff was well and efficiently sewered, and few towns could boast of a better system of sewerage. Every house was provided with one or more water-

* Cleansing superintendents except where otherwise stated.

closets; there were no cesspools, middens, or ash-pits in the city.

WATER SUPPLY.

Up to the year 1850 the town was dependent for its water upon various private and public wells. In that year an Act was obtained by the Cardiff Waterworks Company, empowering them to construct works near the river Ely, about 3 miles from the town, the water there being derived from the dolomite formation of the old red sandstone taken into culverts running alongside the river Ely, and then pumped into service reservoirs for the supply of the town and district.

In 1860 the company obtained further powers, enabling them to take the waters of various streams on the limestone gathering grounds at Lisvane, three to four miles from Cardiff, and to construct at Lisvane a storage reservoir holding 80,000,000 gallons of water, together with filter-beds, the town being supplied from this source by gravitation.

In the year 1879 the Cardiff Corporation obtained an Act of Parliament empowering them to purchase the whole of the existing water undertaking from the company, and the purchase of the works was shortly afterwards completed, the amount paid to the company being £320,000.

It was found that the existing works would soon prove inadequate to meet the increasing consumption of water, owing to the very rapid growth of the town and district; and after an exhaustive inquiry into the merits of several sources for future supply, it was decided to promote a Bill in Parliament to obtain water from the Taff Fawr Valley, in Brecknockshire, situate on the old red sandstone formation, about thirty miles from Cardiff.

In order to meet the pressing needs of the town, another large storage reservoir was commenced at Llanishen in 1884 and completed in 1886, this adjoining the existing Lisvane reservoir, and being capable of holding 300,000,000 gallons of water.

New filter beds for efficiently filtering 3,000,000 to 4,000,000 gallons per day on the most approved principles were built near the "Heath," 1½ miles from Cardiff, at the same time as the storage reservoir at Llanishen, and these had since been enlarged.

In the meantime the Act authorising the works in the Taff Fawr Valley was obtained, and two new reservoirs, with a capacity of 668,000,000 gallons, were constructed in the new watershed and the necessary mains laid between those and the Cardiff works, while a third reservoir of a capacity of 1,200,000 gallons was in course of construction until recently, but operations had for obvious reasons been suspended for the time being.

In the Taff Fawr Valley the corporation had one of the finest watersheds in the kingdom, with an abundant supply of pure soft water, eminently suitable for all domestic and manufacturing purposes.

The effect produced on the public health of the district by the various public works which have been constructed might be seen in the reduction of the death rate which has taken place.

HIGHWAYS.

The streets of the city were wide, well kept, and in ordinary times exceedingly well lighted. The total length of highways in the city was now 135 miles. The carriageways of the main thoroughfares were wood paved or asphalted and the remainder macadamised, and the footways were well flagged. About 32 miles of electric tramways, the property of the city council, were laid along the main thoroughfares.

OPEN SPACES.

Until the year 1888 the city did not possess a single park or open space of any description. Since then, however, the corporation had acquired, partly by gifts and partly by purchase, a large number of parks and open spaces for the free use of the public, and at the present time could fairly claim in this respect to have done its duty to the public, and there was no work of the city council which was more appreciated.

CIVIC CENTRE.

Cardiff could safely claim, in the matter of town planning, to have the finest civic centre in the United Kingdom and to have set an example to other cities worthy of being followed.

Owing to the abnormally rapid growth of the population of the city in the latter part of the last century it would be readily understood that all the public institutions had become too small for the proper carrying out of the work, and proposals of various kinds were made for the better accommodation and better buildings in which to carry on the public operations of the city with the result that in December, 1898, the Cathays Park, comprising some 60 acres of land, was acquired from the Marquis of Bute for the sum of £160,000, and since then there had been grouped on the site the city hall, law courts, the University of Wales Registry Offices, the Glamorgan County Offices, the first section of the University College of South Wales and Monmouthshire, the new Technical College, and now in course of erection was the first section of the National Museum of Wales. A site at the north-west corner of the park had been granted to the Government for the erection of a fine block of Government buildings, and these would have been in course of erection now but for the outbreak of war.

The land was not yet all appropriated, and there were still some excellent sites available for such further public buildings as might be required; but what had been done on this site in the matter of public buildings in the first eighteen years would, he thought, be acknowledged as a fine achievement.

Having been associated with the city in the capacity of public servant of more or less importance during the last forty years of these extraordinary evolutions of the city, he thought he might justly feel some amount of pride in the part he had played in the building of the city, and in bringing into being the metropolis of Wales.

HOUSING AND TOWN PLANNING.

SCOTTISH LOCAL GOVERNMENT BOARD'S REPORT.

The partial suspension, owing to the war, of the customary operations under the Housing Acts is one of the matters touched upon in the annual report of the Local Government Board for Scotland. The Board point out that the stagnation applies not only to municipal schemes, but also to private building enterprise, with the result that, despite the large exodus of men due to enlistment, the demand for working-class houses is still pronounced. Consequently, the board have advised local authorities to endeavour to secure the repair rather than the closure of houses, except in cases where closure is urgently necessary for the removal of nuisances or the protection of health.

While it is impossible to predict when the work of housing may be resumed, it is conceivable that the cessation of hostilities may suggest the initiation of schemes. Accordingly, the board are of opinion that where a scarcity of housing exists local authorities should be prepared to put work in hand immediately the occasion so demands. To that end probable sites should be considered and their lay-out determined. The number and character of houses required should also be estimated and plans prepared. The board are ready to assist so far as their resources permit.

The Board acknowledge the effective co-operation of local authorities in solving problems in particular districts in regard to the accommodation of war workers, and mention that practically throughout the year the department's housing staff were engaged upon work of this nature.

The war also necessitated a general curtailment of activity in town planning, and the question was left almost entirely to the discretion of the local authorities. The board gave authority to the preparation of schemes by the local authorities of the burghs of Ayr, Edinburgh (Murrayfield, Camby Bank, &c., area), and Kirkcaldy. Eight applications for authority to prepare schemes were received during the year from the local authorities of the Middle Ward District of Lanarkshire (Cambuslang and Carmyle areas), the Lower Ward District of Lanarkshire (Burnside area), the Upper District of Renfrewshire (Easter Renfrew area), and the burghs of Ayr, Edinburgh (Duddingston, &c., area), Glasgow (Kennyhill and Riddrie area), and Rutherglen.

Road Damage in Cornwall.—In reference to a complaint by the Camborne Urban District Council of damage to roads caused by heavy tractors, the Highways Committee, with a view to avoiding litigation, suggest a settlement by the company concerned making use of lighter tractors and paying 3d. per ton per mile for traction-engine traffic.

Law Notes.

EDITED BY J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion queriets are requested to use distinctive words as nome de plume. The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.

HIGHWAY REPAIR: MOTOR TRAFFIC. "Urban" writes: This council has recently been requested by a large farmer to repair which practically means reconstruction a certain section of road, 6 furlongs 7 chains in length, at the extreme boundary of the district, and end of an old metalled highway upwards of 6 miles in length, in order that he can utilise the road for heavy motors for carrying his produce—chiefly potatoes—from his farms to a railway station, 7 miles distant. The road is practically a cul-de-sac, there being no continuation beyond the point of termination near his farms. Hitherto, from time immemorial, the section of road has been maintained and kept in a condition sufficient for the traffic of the district, which is purely agricultural, and no question has previously arisen in regard to the section of road being kept otherwise than in a satisfactory condition. In the early part of the current year a heavy motor, with trailer combined, commenced to use the road, carting farm produce as above mentioned, and within six weeks had done more damage than the ordinary traffic of the district had done in the previous three years. In fact, it made the road wellnigh impassable. Repairs have been carried out since the damage was done, and the farmer in question admits the road is again all right, but contends it will not be of sufficient strength for his heavy motor traffic when it commences again, which will be very shortly. (1) Is this council compelled by statute or otherwise to reconstruct the section of road as requested for such traffic, the cost of which will be not less than £500? This would mean a supplementary rate of 10d. in the £ upon the rural area of the urban district, owing to such an expenditure not being provided for in the estimates for current year, which were passed in March last by the council; (2) can any portion of such sum be recovered by the council towards the cost of such work if carried out; (3) can the council recover the cost or any portion thereof for damage done by such heavy motor traffic if continued in future? The road in question throughout its entire length has never been maintained in a condition for carrying heavy motor traffic, it being generally narrow and not more than 10 ft. 6 in. wide at any point. Further, such heavy motor traffic hitherto had never been contemplated upon the road.

(1) It is the duty of the council to keep the road upto-date (*i.e.*, in a reasonably fit state to bear the traffic (including motor traffic which may reasonably be expected to come upon it. See *Cheshire Corporation* v. *Foster* (1906, 1 K.B., 167). (2) If the road was in a good state of repair, sufficient for the ordinary traffic, prior to the commencement of the motor traffic, I think the council could recover from the person by or by whose order such traffic was conducted the extra expense attributable thereto. (3) If the road is put into a state reasonably fit to bear the expected motor traffic, then, in the event of such traffic exceeding reasonable limits, whether by reason of excessive weight, frequency of journeys, or otherwise, the council would probably succeed in recovering at all events some portion of the damage.

BUILDING BY-LAWS: AIR SPACE.—"H. B. C." writes: Plans have been submitted for a proposed cottage and the amount of air-space allowed has been the source of some trouble. The cottage is to front on a narrow and old roadway, which was laid out before the by-laws were made by the council. This road has been considered as a street, 17 ft. in width, and therefore requiring the space in front of the cottage to be 20 ft. 6 in. This width is not obtained opposite a projecting part of the house on the opposite side of the road. Should this width be also 20 ft. 6 in. or less, owing to the road being narrower (10 ft. 6 in.)? The plans have been altered to show part of the wall of the washhouse immediately opposite this projection set back to give a width of 17 ft. 3 in. Do you consider this alteration would make the plan in order as regards front space? With regard to the space in the rear, this is only about 5 ft., but from the proviso (c) in enclosed revised by-laws it appears that space cannot be required in the rear if provision is made at the sides. The required depth of space (16 ft. for a house 25 ft. high) is not given over the whole depth of space on one of the sides. Would the proposing builder be correcting this by altering the position of part of back wall?

As to the front space. The first part of by-law 3 refers to the width of the street *at the point where such building may front thereon*, and although these words are not repeated in the subsequent part of the by-law, I think that, upon a reasonable interpretation, where (as in this case) a building fronts on a street of varying width, the prescribed distance may vary at different parts of the building, being measured having regard to the width of the street at the point of measurement. I think, therefore, that the proposed alteration would make the plan in order as to the front space. As to the side space: I think that the proposed alteration of the back wall would make this space in order.

HIGHWAY RETAINING WALL. DANGER TO CHILDREN. "YNYS" writes: My council's attention has been called to the danger involved to young children by their climbing a retaining wall adjoining a highway in this urban district, and sitting with their legs over the precipice on the outer side, and also in walking and running along the flat coping. And it is also suggested that in case of a serious accident to a child, or children, the council could not escape blame or responsibility in the matter. I shall be obliged if you will kindly advise whether the council could be in any way held liable or responsible in case of accidents, seeing that the wall is 4 ft. 6 in. high from the surface of the road, and in good condition.

It is impossible to express a decided opinion upon a hypothetical case. A great deal would depend upon the particular circumstances, and the view taken by the judge and the jury (if any) with respect thereto. But, assuming that the wall forms part of the highway for the purpose of repair, I think it is highly probable that, in the event of such an accident as suggested, the council would be held liable, especially as their attention has been called to the matter.

HIGHWAY: STRAYING POULTRY. "S. R." writes: I shall be glad if you will kindly give me your opinion as to the following: A man keeps poultry in a field alongside a narrow public highway and very frequently they wander over the road and are a danger to anyone cycling along, and one or two persons have been thrown from their machines by the fowls flying across and coming into contact with the motor cycle. (1) Can the authorities compel him to keep his poultry off the road; (2) can any person who is injured in consequence of the poultry recover damages; (3) if any of the hens are killed by a motor car can the owner of the poultry sue the motorist for damages?

(1) There appears to be no duty on the part of a landowner to keep poultry off the highway, or to fence his land to prevent them from escaping, and no means of compelling him to do so. (2) I do not think any person injured in consequence of poultry being on the road could recover damages. See *Hadwell* v. *Righton* (1907, 2 K.B., 345). (3) This would depend upon circumstances. The owner would, I think, have to prove gross negligence on the part of the motorist in order to succeed.

NUISANCE BY NOISE: PROCEDURE TO REMEDY. "YNYS" writes: A field adjoining a chapel in this town is being let for circuses, shows, &c., and the chapel authorities complain of the nuisance thereby caused by noise, &c., interfering with the conduct of the week-night services. Will you please advise me what remedy there is to get the nuisance abated, and how to proceed?

The question whether noise amounts to a legal nuisance is always a question of degree, and depends partly upon the character of the neighbourhood. The remedy is by proceedings in the Chancery Division of the High Court for an injunction. The following have been held to be legal nuisances, and injunctions have been granted in respect thereof: A circus near a house, performing three hours every evening for eight weeks (*Inchbald* v. *Robinson*, L.R., 4 Ch., 388); merry-go-rounds near a house (*Lampton* v. *Mellish*, 3 Ch., 163); a rifle-gallery, organ, and roundabout near a house (*Winter* v. *Baker*, 3 T.L.R., 569); horse-racing on Sundays (*Dowd* v. *City and Suburban Racecourse Company*, 1899, 1 Ir. R., 345).

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING AT BLACKPOOL.—(4.)

At the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool, Mr. W. H. Schofield, Assoc.M.Inst.C.E., submitted for the consideration of the members a paper entitled:—

IMPROVEMENTS OF HIGHWAYS TO MEET MODERN CONDITIONS OF TRAFFIC.

The paper is reproduced on another page of this issue.

Mr. C. F. Gettings (Worcestershire) proposed a hearty vote of thanks to Mr. Schofield for his paper. He thought Mr. Schofield had given many of them credit for knowing more than they did, and he was sorry that he had not, in his paper, given them a little more of his experience with some of the material he had laid under the very heavy conditions of traffic which existed in Lancashire. Outside London he looked upon Lancashire as one of the heaviest traffic counties, and he could only put it down to Mr. Schofield's modesty that he thought the information would be rather unnecessary. Personally, he would be only too pleased to learn a little more of his experiences. Speaking as a county man, he could say that those who had large mileages of roads to deal with, and practically with no foundation, knew what it was when they got new traffic such as they had had during the past two or three years—he was referring particularly to motor omnibus traffic. He was afraid in many boroughs and urban districts they did not appreciate the difficulties the counties were working under, because in the urban districts and boroughs they had from time to time built up a stronger foundation, not necessarily a pitched foundation, but they had added considerable quantities of street metal which had strengthened their roads, so that the traffic which had come upon them suddenly had not affected those roads as it had the county roads. The question of rubber tyres had been mentioned. He looked upon that, especially for the counties, as a most important thing. Possibly a little experience he had had in his own county would rather substantiate the view of an owner who worked a number of these vehicles. Some five years ago he had to take up mechanical traction in order to carry the large quantities of material they now required. They did not own all their own vehicles, but they hired at that time about six lorries, all of which were steel tyred. For two years he watched the effect of these lorries. They had to work them in the winter time to get the material in; they could not work in summer. Unfortunately, the lorries had to work on weak roads, and he found their roads were cut up worse by their own traffic than any other traffic they had to carry. He went into the matter with the man who was supplying the vehicles, and he had two of the lorries fitted with rubber tyres. The man said: "I shall want an extra 6d. per ton." After watching the effect of the rubber tyres on the road, he said: "Now I am going to stipulate that the whole of your machines are tyred with rubber." He said: "You will pay me the extra?" to which he replied: "Not a penny." The man jibbed a bit, but eventually he accepted. Two years later he put an extra six on the road. The man was now running eighteen vehicles, all rubber tyred. He was tyring his vehicles with rubber because it paid him on the mileage. He thought that contractor was making money. In the paper Mr. Schofield referred to the Statistics of Traffic (Summary Form) issued by the Road Board. Mr. Schofield did not say in what respect his form differed from that of the Road Board It would be useful if he could give the information so far as Lancashire was concerned. Mr. Schofield referred to hand-pitched foundations. He thought they would all agree that the hand-pitching of the foundation was the proper thing to do, but the cost was very considerable, and he was afraid that very few of them could entertain that, although they would like to. In his county they were doing a large amount of strengthening work. They were using principally slag, which was the local material, in size from 4 to 8 in., and they were putting that on with forks. They had had occasion to break that slag up at times, and it was astonishing how that material had gone together. It was just like iron itself. If they kept the material of a suitable size it was hardly necessary to do more than that, unless it was an exceedingly heavy traffic road. They were getting from 1,000 to 2,000 tons of traffic per day, and he had roads which were carrying more than 2,000 tons per day. Mr. Schofield referred to the use of tarred iron slag macadam. He was pleased to say that Mr. Schofield's experience agreed with his own, but he thought there Mr. Schofield had not given them any data. It would be useful if he could give them the width of the road, the tonnage per day, whether it had a good foundation, the class of traffic, whether motor 'bus or motor lorry, and the cost. He did not think it was fair to shoot these questions off hand, and he had previously written to Mr. Schofield and asked him to give figures. There was one other point. Mr. Schofield referred to Durax paving. Now, Mr. Schofield had had considerable experience with tar-macadam, and it would be advantageous if he could give them any information as to when he considered it was better to abandon tar-macadam and adopt either a Durax or a sett paving. There was one other question as to tar-macadam, and a very important one—that was as to renewals. Mr. Schofield had had a number of years' experience of tar-macadam, and he anticipated that he had had to renew some of it; if he had not, then he was very fortunate. Mr. Schofield's views as to the best methods of renewing a tar-macadam surface would be very useful. He had put down tar-macadam on roads, although he knew they would have a heavy traffic. He wanted to get the bottom of the road right first. If they got the bottom right and consolidated, they could at a later date apply a better surface material. They had gained experience with different kinds of material coming on the market, and perhaps Mr. Schofield had experience of where he had to renew his tar-macadam with some other kind of material.

Mr. S. S. Platt (Rochdale), who seconded the vote of thanks, said he agreed entirely as to substituting sett pavement as the most economical in the long run for roads which were subject to heavy traffic, but he would like to ask Mr. Schofield whether he had found any difficulty through having a rigid foundation and the heavy motor lorries with iron wheels fetching off pieces of the granite. He did not mean fetching the corners off, but actually smashing them up. If anybody had asked him a few years ago, he would glibly have given them the life of a granite sett paved road, but he would not do so to-day. He would like to ask Mr. Schofield whether he had any experience of providing a resilient bed between the concrete and the setts or whether the only remedy was to apply rubber tyres. There was no doubt about it that with iron tyres they would get the weight resting on points, and that was where the fracture took place. He had not read that Mr. Schofield had any experience of Rocmac in surfacing roads, and whether there was any interstitial wear. His experience was that it was ground down at the top but below it was as hard as concrete. He had some experience when he had to have some scarified out. It nearly pulled the inside of the machine out. He quite agreed as to tar-grouted macadam; they had only a varying degree of success. As to Durax paving, he had always been against it, because for one or two shillings a yard more they would get a proper pavement. He quite agreed that the old rule as to the width of 8 ft. for each line of traffic was insufficient, and where there was no regulation of traffic even 9 ft. 6 in. between the kerb and the tramway was not sufficient. He did not know whether Mr. Schofield thought there should be some legislation, because it had got to be a very serious matter.

Mr. H. G. Whyatt (Great Grimsby) said Mr. Schofield had called attention to the growth of traffic on the Liverpool and Manchester road. He was specially interested in that because he lived just off that road for thirty years. Looking at the figures it struck him that a great change had come over it in the last five years. The first figure was 1,104 mechanically propelled vehicles in seven days, carrying 2,236 tons; that was approximately 2 tons per load. This year they had, in seven days, 2,953 mechanically propelled

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vehicles, carrying 15,715 tons, which was approximately 6 tons per load, showing that the road was coming very much more into use for heavy traffic. Between Liverpool and Manchester there were two or three railways, the Bridgwater Canal, the Ship Canal, and, possibly, other means of conveyance. The people who brought goods by those methods, whether by railway or canal, had to pay freightage on those goods. The owners of motor vehicles had found that if they brought those goods by road they had to pay nothing towards the cost of the road—that was paid by the highway authorities. That traffic had grown to such an enormous extent that the time had come when there should be some means of making the owners of those vehicles pay towards the cost of the roads over which they travelled. On other roads, for instance, the Preston and Blackpool road, where five years ago the load was nearly 3 tons per vehicle, it had gone down to 2¼ tons. That was the converse. On the figures of the loads on the Preston-Blackpool road there was very little to be said, but on the figures of the traffic on the main road from Manchester to Liverpool there was a good deal to be said, for Mr. Schofield's contention that the motor vehicles ought to pay towards the cost of the roads.

Mr. W. J. HADFIELD (Sheffield) said in Sheffield they had a good deal of experience with heavy traffic, and he quite agreed with Mr. Schofield that tar-macadam was among the best materials for holding up to traffic. They had 1,000,000 sq. yds. of tar-macadam in Sheffield, all of which they had made themselves. He ventured to say that 990,000 yds. of it was in good order and a success. He was not the pioneer of this paving; it was laid down by Mr. Wike and his predecessor. It had been laid down twenty years and they had never seen the bottom coat. On the roads on which tar-macadam was not suitable the theory in the past had been to lay setts. The economy of setts was disappearing. The steel-tyred vehicles in particular played havoc with them, and while they used to ask for twenty years for loans for setts they now asked for only fifteen years. That spoke for itself. One of their heaviest traffic roads, the road between Sheffield and Rotherham, was laid part with setts and part with tar-macadam and the tar-macadam was wearing best.

The PRESIDENT (Mr. J. S. Brodie): Is it slag tar-macadam?

Mr. HADFIELD: Yes. The time was coming when these steel-tyred heavy motor lorries would disappear and rubber-tyred vehicles take their place. They had a reinforced concrete road with an asphaltic surface on it. They were going in for 8 in. thick of concrete with British reinforcement and 2 in. of asphaltic surface, according to the traffic. He was quite convinced that where there was heavy traffic they must have some binder to seal the surface of the road. The question of street watering and its effect had been referred to. The proper thing was to get the dust off the street, which they could do with a smooth surface.

Mr. H. T. CHAPMAN (Kent) said he had the pleasure of serving under Mr. Schofield in Lancashire for ten years, and he knew that the conditions in Lancashire, both as regarded traffic and characteristics generally, were as varied as any other county in the country. He also knew Mr. Schofield was as solid a county surveyor as any they had, and he did not speak hypothetically. Mr. Schofield had given some details of the great increase in mechanically propelled vehicles on certain roads, but he did not tell them the proportion of the mechanically propelled loads to the total traffic. He found in Kent something like 60 per cent in volume of the traffic was motor propelled. Mr. Schofield mentioned a hand-pitched foundation. He would like to know if he put any material in the pitching such as ashes or clinker, because he remembered when he was in Lancashire they had a very great deal of difficulty with the Preston road—the portion which was in the borough. However large pitching they put in, clay came up through it. He thought they must have some more homogeneous foundation than hand pitchings. On a clay foundation the pitching was working down and the clay was working up. As to Durax paving, the one thing to be said for it was that they could lay it upon the old macadam surface. Unless they had Durax paving on concrete they would have trouble with it." They must have the paving held up to the traffic, but he would not say rigid, because in his opinion it was very desirable to have a certain amount of resiliency to prevent the large amount of compression of heavy traffic. With regard to road widenings, he was with Mr. Schofield all the way. He thought many of the road widenings and improvements had been dangerous. They had made for greater speeds, and thus led to more danger. He should like to mention street watering. Except on very rare occasions, street watering was not necessary for maintenance purposes, it was water for destruction. In his county they refused to contribute for watering roads which had been tar-painted, and for bituminous surfaces it was unnecessary and more destructive than beneficial.

Mr. W. FINCH (Cumberland) said that in Cumberland they had laid a considerable amount of tarred granite, which came to them prepared from the quarries. He would like to ask whether that was the case with the tar-macadam Mr. Schofield used, or did he mix it himself? The fault with the tar-macadam he had used had not been with the granite, but with the tar. On certain roads, where the conditions were exactly similar, and the stone was mixed in the same way, one had roads which had been made five or six years with an excellent surface, but other portions had worn out on the surface in from twelve to eighteen months. That was the fault of the tar, and something ought to be done by the distillers or others who were producing tar to give them a thoroughly reliable tar for all purposes. With regard to the tar-grouted section they had laid, it had been more successful than the tar-macadam. He had a section which was laid on the road carrying the heavy traffic from Gretna. That was tar-grouted, and had stood very well.

The PRESIDENT: What kind of granite are you using there?

Mr. FINCH said in his case it was Threlkeld granite. With regard to widenings he thought these ought to be encouraged. In order to encourage the local authorities the Cumberland County Council had given grants in every case where a road in junction with a main road was widened, and before the war they had many of these widenings. He thought it would be much better if the aldermen and councillors of their authorities were present at these meetings, because at present they said they would only spend a certain amount of money on the roads. Instead of encouraging the authorities to make a good job by putting down good roads the Government cut down his estimate by one-half, so the Government were to blame in that case, as they might have assisted the county council in that direction, as the life of the road would have been increased.

(To be continued.)

Street Watering with Electric Vehicles.*

By JAMES BEE, Cleansing Superintendent, Blackpool.

At some of our previous conferences we have had discussions respecting the introduction of electric vehicles for municipal work, and for some time I have been convinced that for our town to be really up to date it was necessary that the work of street watering should be carried out by means of a motor vehicle; but what I wanted was something which would not only carry out the work efficiently and economically, but a vehicle smart in appearance, and in keeping with Blackpool's motto of "Progress."

In the electric street-watering vehicle which we obtained last year, we have obtained one which I have no hesitation in saying meets both these conditions. Since it was placed on the streets it has been the object of many complimentary remarks from both residents and visitors, and I am safe in saying that we have never had any machine come into the town which has been so much appreciated, and which has given such satisfaction as this vehicle has done. I think those present will agree with me when I say that no better evidence could be required as to the vehicle having given the utmost satisfaction than the action which my committee have recently taken in ordering another identically similar machine, after less than twelve months' experience.

Blackpool's Electric Street-watering Vehicle.

Although petrol motors had been very extensively introduced into municipal work, the electric vehicle for heavy work was practically unknown. It was therefore rather a bold stroke, and a little risky, to assume the responsibility of recommending the expenditure of nearly £1,000 on the purchase of an electric vehicle for street watering purposes. However, it is necessary for someone to experiment if we are to make any progress at all, so, after very careful consideration, the chairman and myself decided to urge the Cleansing Committee to obtain an electric vehicle.

The work of street watering is one of the most important duties which a cleansing superintendent has to perform, and one which causes him no little anxiety; and it is essential therefore, if he is to give satisfaction, that he should be provided with the most up-to-date appliances. Not only is dust a great nuisance to the shopkeeper in spoiling the goods he has displayed for sale, but it constitutes one of the greatest factors in the spread of infectious disease, and one of the worst dangers to the public health. Not only with reference to street watering, but to other duties carried out by cleansing departments, it should be remembered that the nature of the work is such as to be absolutely necessary for safeguarding the health of the people, and that any money spent on its equipment is money well invested.

Whatever regard we still cherish for the horse—and no one will undervalue the work it has rendered in the past—we cannot allow sentiment to impede the march of progress. When we see the motor-watering vehicle moving along doing its work at the same speed as the quickly moving vehicular traffic, we at once realise how utterly out of date the slow-moving and cumbersome horse-drawn vehicle really is. Further, there is no "jibbing," or going dull to work, as we often experience with horses that have had a few hard days' work; or resting days because they have not been eating their food; or of stopping in for shoeing; all of which invariably happen during the worst dusty days when watering is urgently required. Not only does the horse-drawn watering cart interfere with the traffic owing to its slow speed, but an excessive quantity of water is put on the roads, and it becomes a mere water waster. Excessive watering is not good for any class of road, and especially so with regard to macadam roads, of which we have a great percentage. Macadam roads, watered excessively with salt water, become dirty for pedestrians, while the vehicular traffic plucks up the metal and damages the road. With the motor this is avoided, as only sufficient water is put on the road to lay the dust, and as we have not had a single complaint this year, I think we can take it for granted that the work has been efficiently carried out.

Our electric street-watering vehicle was obtained in July of last year from the General Vehicle Company, Limited, Imperial House, Kingsway, London, at a cost of £974. The chassis is a 3½-tons one, and is 18 ft. 6 in. long and 6 ft. 9 in. wide. The wheels are fitted with solid rubber tyres, the front ones being single and the back ones twin, and are chain-driven. The tank, which is cylindrical in shape, has a capacity of 750 gallons, and is fitted with sleeve valve sprinklers. The spray operates at the front of the vehicle, this making it easier of control by the driver, as there is no necessity for him to turn his head to see where the water is going. With fast-

* Paper read at the annual conference of the Institute of Cleansing Superintendents, held at Cardiff.

moving vehicles this arrangement is of the utmost importance. There is a large pump provided, as the pressure of water at the Hydrical tank produces a spray sufficient to water a street 7 yds. wide.

The batteries for providing the motive power are by the Exide and consist of forty-four cells. We have installed apparatus for the purpose of recharging the batteries from our refuse destructor electric plant. By this means we are able to obtain the power without any cost to the department, and in my opinion this constitutes a very convincing argument in favour of the electric vehicle in preference to its petrol-driven competitor. With the present high price and scarcity of petrol, we are now certainly reaping considerable benefit by having decided in favour of the electric vehicle. The recharging of the batteries is carried out during the night, and takes about six hours to accomplish. When the batteries are fully charged, the current is automatically cut off. Although the vehicle is supposed to travel 40 miles at one charging, with ordinary work, it must be remembered that in street watering you have always to travel with a no load out, and it cannot be compared therefore with a vehicle taking a load a long distance and returning empty at one charging. Another point which must be taken into consideration is that the vehicle is called upon to move a great weight during the course of the day, and in addition to this it is loaded up many times, and, as is the case with vehicles of any description, it takes extra power to start it. Under these circumstances we have never run the vehicle more than about 30 miles without it being boosted up, although if we had desired to do so we could have run it a few more miles; but it is not wise to run the batteries too low. The general course adopted is for the vehicle to turn out in the morning and work about five hours. During this period it waters about 25 miles of streets, using fourteen loads (about 9,100 gallons) of water. During dinner-time it is given a boosting charge of about 1½ to 2 hours' duration, and it then goes out for the afternoon, completing the day's work. By this means there is no danger of running the batteries empty, and being unable to return to the depot. So far we have never had the slightest difficulty in this respect, and if the driver will only keep an observant eye on the meter, he will run no risk whatever of being stranded. I would like to state here that we have found the electric vehicle easy to drive, and an ordinary horse driver can be taught in a few hours, providing, of course, he is intelligent, and capable of picking up a little knowledge of machinery. It is also important that the man should have a thorough practical knowledge of street watering if he is to be a success. It is of little use having a good machine unless it is in charge of a capable man; one who will take an interest in looking after it, and at the same time get as much work out of it as he can.

Turning to the actual work which the vehicle is capable of accomplishing, and when all is said and done this is what really appeals to us, and what the members will desire to know, it is rather unfortunate that we only obtained the vehicle in the last week of July, as I should have very much liked to have placed before you a full watering season's results. The figures which I shall place before you will be, I hope, just as convincing, as they refer to what the vehicle has actually done under ordinary working conditions during April and May of this year, compared with the same two months of last year.

I might mention that the cost of power in the following figures is worked out on the basis of 1½ units per mile.

STREET WATERING DURING APRIL AND MAY, 1916.

	Electric vehicle.				Horse vans.		
	Days at work.	Hours worked.	Miles watered.	Gallons of water.	Days at work.	Hours worked.	Gallons of water.
April ..	21	115	57[illegible]	192,750	14	90	57,750
May ..	24	144	[illegible]	232,050	15	289½	165,450
Total ..	45	259	130[illegible]	424,800	28	379½	223,200

Number of days on which streets were watered ... 45
Total number of hours worked 638½
Total gallons of salt water used 648,000

STREET WATERING DURING APRIL AND MAY, 1915.

	Corporation carts.			Hired carts.		
	Days at work.	Hours worked.	Gallons of water.	Days at work.	Hours worked.	Gallons of water.
April ..	21	717	381,300	14	122½	67,900
May ..	27	1,515	820,750	22	326	172,550
Total ..	48	2,232	1,205,050	36	448½	240,450

Number of days on which streets were watered ... 48
Total number of hours worked 2,680½
Total gallons of salt water used 1,445,500

COST OF STREET WATERING TO MAY 31ST (2 months).

		£ s. d.	£ s. d.
1916—			
Wages—Motor driver ...		8 7 4	
Horse drivers ..	...	10 3 0	
Hire of horses from highway dept.		10 5 10	
Depreciation—Vehicle ...	£12		
Batteries .	£8		
Tyres ..	£4		
		24 0 0	
Sundries—Insurance, oil, &c. ...		2 10 0	
Power—1,902 units at 1d. ...	...	7 18 6	
Water	...	16 3 0	
			79 7 8
1915—			
Wages—Horse drivers ...	...	58 12 8	
Hire of horses from highway dept.		60 9 0	
Hired carts (horses and drivers) ...		19 10 5	
Water	.	36 2 9	
			174 14 10

Total saving on the two months—£95 7s. 2d.

In my opinion, the electric vehicle is quite capable of doing the work of six horse vans, and as it might be of interest to the members, I have estimated what the saving would be per week (5½ days) on this basis.

COST OF ELECTRIC VEHICLE PER WEEK.

	£ s. d.	£ s. d.
Driver's wages	1 15 0	
Power—384 units at 1d.	1 12 0	
Depreciation...	2 10 0	
Sundries, insurance, oil, &c. ...	0 6 0	
Water—84,500 gallons ...	2 2 3	
		8 5 3

COST OF SIX WATERING VANS PER WEEK.

	£ s. d.	£ s. d.
Six drivers' wages at 29s.	8 14 0	
Hire of six horses at 27s	8 2 0	
Water—173,000 gallons .	4 6 3	
		21 2 3

Estimated saving per week—£12 17s. 0d.

The following figures represent the actual work accomplished by the vehicle during a recent week, including Saturday afternoon and Sunday morning.

Day.	Miles watered.	Hours worked.	Loads of water.	Gallons of water.
Monday ...	16[illegible]	9	24	15,600
Tuesday	15[illegible]	9	24	15,600
Wednesday ...	14[illegible]	9	23	14,950
Thursday . ..	14[illegible]	9	23	14,950
Friday ...	16[illegible]	9	23	14,950
Saturday	45[illegible]	9	22	14,300
Sunday ...	5[illegible]	5½	14	9,100
Total	3[illegible]	59½	153	99,450

As an illustration of what the electric vehicle has saved in week-end street watering alone, it has only been found necessary on Saturday afternoons to have the vehicle at work, while on Sunday mornings we have one horse van at work in the extreme south end of the borough, all the rest of the town being watered by means of the electric vehicle. I might mention that under similar conditions in former years it would have been necessary to employ twelve to fourteen horse-drawn vans.

Before leaving the question of figures, I should just like to refer to one other example of how the vehicle has already effected a considerable saving. It has been our practice during the season to employ a gang of men during the night to swill the promenade; but, being short of men owing to enlistments, I was unable last summer to adopt this method. However, I found

that by means of the electric vehicle the work could be quite as efficiently carried out; as we were able to swill the whole length of our promenade each morning by this means. In addition to a considerable economy in labour there was a saving of about £50 in water alone.

However excellent a vehicle may be for street watering purposes, it will not be a success unless there is every facility for quick loading, and I am pleased to say that in our town we are exceptionally well placed in this respect. We have now salt-water mains laid to all parts of the town; the council have recently extended them at a cost of £7,000. From the main which runs the length of our promenade the electric vehicle can load in about five minutes, while the average time for loading in any part of the town is about ten minutes. Nothing but salt water is used for watering and washing streets, and flushing gullies and sewers.

Although the machine was obtained for street watering, its usefulness is not confined to that sphere of work alone, as it has already during the past winter been employed for the purpose of sewer cleansing. With a flush of 750 gallons the sewer is in most cases thoroughly cleansed, the vehicle being provided with a special valve for this work. In many cases it has saved us the trouble of having to resort to dredging operations, which are both slow and costly.

In conjunction with a Laffly motor sweeper, the electric vehicle has also been extensively employed on street washing operations; the two motors doing the work rapidly and efficiently.

As stated earlier in my paper, the present electric street watering vehicle has given us such entire satisfaction that the Cleansing Committee have ordered the same firm to supply a further vehicle, similar in every respect to the first one, at a cost of £1,028. This will enable us to dispense with horse-drawn vans entirely, as by means of the two electric vehicles we shall be able to water the whole of the town, which, for street watering purposes, will be divided into north and south.

In conclusion, I am fully convinced that the results obtained from the use of electric vehicles, not only in Blackpool, but in other towns as well, indicate that within the next few years great progress will be made by this class of vehicle, and that it will be extensively introduced into municipal work, for which it is so admirably adapted.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Queenstown U.D.C. (July 4th. Mr. A. D. Price).—£600 for the completion of the duplicate water main from Tibbotstown. It was explained that a tender of £9,717 had been accepted in connection with the waterworks just before the outbreak of war, and that owing to subsequent delays and difficulties with respect to obtaining materials the expenditure exceeded the estimate. The proposed loan of £600 was for the purpose of discharging their outstanding liabilities. There were no new works of any kind. The works were completed, and since the day of completion the water supply, particularly to Haulbowline, had been most satisfactory. Haulbowline had got its full supply. Owing to the war the dockyard and Admiralty requirements had been substantially increased, and all the water required had been supplied without the least difficulty or delay.

APPLICATIONS FOR LOANS.

Wigan T.C.—£535 for pumping plant, £325 for electric cable, and £1,613 for constructional and pipe work.

Worcester T.C.—£14,000 for additional electricity plant.

LOANS SANCTIONED.

Branston R.D.C.—£350 for works of sewerage.

Hereford T.C.—£18,000 for electricity connections.

Upton-on-Severn R.D.C.—£1,541 for the extension of the Kempsey sewage disposal works.

FORTHCOMING INQUIRIES.

JULY.	£
25.—**Gloucester.** For works of sewerage (Mr. W. O. E. Meade-King) ...	1,606
26.—**Bristol.** For the purpose of a burial ground (Mr. W. O. E. Meade-King) ...	—

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Was not the paper read before the meeting of the Association of Managers of Sewage Disposal Works at Sheffield, by Dr. Sidney Barwise, the county medical officer of health of Derbyshire, an excellent *résumé* of the history of the sewage question, and did it not contain a vast amount of concentrated information? Is it not interesting to note the gradual change of scientific opinion on the proper method for dealing with sewage and the gradual evolution of thought that eventually discovered the importance of the proper application of air to ensure a pure effluent?

* * * *

Is not the London County Council to be congratulated on the financial success of their numerous working-class housing schemes if, as was stated by Sir John Benn recently, the loans on the various schemes are now nearly paid off and the renewals fund stands at £74,000? Did Sir John make any reference, however, to the land which had from time to time been purchased for large schemes which were afterwards abandoned and the land sold?

* * * *

Was there any occasion for the recent meeting of the Salmon and Trout Association to pass a resolution in favour of a Bill being brought into Parliament enabling an individual to take action against anyone who used crude tar for road making or mending? Have there been any authentic cases of fish poisoning arising from the application of tar or similar compounds upon roads where proper precautions have been taken to prevent its admission into a stream or river? Is not this fish-poisoning scare a bit of a "bogey"?

* * * *

Is it not to be hoped that everyone, of all ranks and classes, in the United Kingdom will respond cheerfully to the Government's demand for no Bank Holiday in August, and thus set a patriotic example to those who are engaged in the all-important work of the supply of munitions, and so help our brave men at the front? Is it not a well-known axiom that a multiplicity of units makes up the great whole, and cannot each citizen "do his bit" at this critical time?

* * * *

How are we to arrive at a solution of the problem as to what we shall do with our house refuse, when, on the one hand, local authorities are asking householders to burn their rubbish, and on the other hand there is a cry for the saving of paper, bottles and so forth? Could there not be a *via media* by which the householder could store the bottles and waste paper and burn what he could of the vegetable and other refuse, and the local authority make some arrangement by which they would periodically collect the bottles and paper on notification from the householder that there was a quantity sufficiently large to justify a special visit for clearance?

* * * *

Could not the general public greatly assist in wartime economies if they would follow a few simple rules? Could they not refrain from throwing paper, orange-peel, banana-skins and omnibus tickets on the surface of the streets and footpaths, see that no waste of water is taking place in their houses, refrain from sending trade circulars through the post, stop writing "chit-chat" letters, and generally try to think of how they can give as little trouble to anybody as possible?

* * * *

Was it not rather interesting to read the report of a discussion which recently took place at a meeting of the Salisbury Town Council on the question as to whether the expenses of their surveyor in attending the annual meeting of the Institution of Municipal and County Engineers should be paid? Whereas, on the one hand, it was urged that "the council ought to set a good example [in saving] and stop these annual outings," was it not, on the other hand, a very sound argument that it would be a good investment of the ratepayers' money for the surveyor to go and hear up-to-date papers read? Are not the council to be congratulated that the resolution to pay the expenses was carried by 16 votes to 2?

Some Results of the Use of Steam Tractors in Cleansing Work at Cardiff.*

By W. HARPUR, M.INST.C.E., City Engineer.

In March, 1904, the Cardiff Corporation purchased two steam motor wagons, and in the following September a further two, for the purpose of superseding horse-drawn wagons in the collection of house refuse from dust receptacles placed along the street-kerb lines by householders, or immediately inside the back garden doors where back lanes were available, the idea being that they would prove more expeditious and economical than horse wagons.

Each motor was fitted with a wagon body, and in addition two trailers were drawn behind, so that a train of three wagons was thus formed.

When collecting refuse the wagons were not brought to a stand, but travelled slowly along, the ashmen picking up the receptacles from each side of the street, and emptying them into one or other of the wagons as they moved along, which was a very laborious and somewhat dangerous occupation, the idea being that to work the steam wagons to the best advantage they should be kept moving.

In the early part of 1906 doubts were expressed by members of the council as to whether any economies had resulted from the new innovation, and I was asked to report on the matter to my committee after ascertaining the cost of refuse collection for a month (1) by means of the steam wagons, and (2) by means of horse-drawn wagons.

Accordingly, I caused careful accounts to be kept, as instructed by my committee, and on April 24, 1906, I reported as follows:—

"In accordance with your instructions I have had the cost of a month's collection of refuse by motor and by horse wagons respectively ascertained, and, after allowing interest on value of the respective plants, motors, horses, wagons, depreciation, repairs, and incidental expenses, I find that the cost of collection by motor works out at 2s. 4·25d. per ton, and by horse wagons at 1s. 8·81d. per ton, or the cost of collection by motor is 35·75 per cent more than by horse traction.

"Recently one of the motors broke down, which gave me an opportunity of a further week's test as to what was the cost of working the district usually cleared by the disabled motor by horse power. This showed the collection by motor wagons in the particular district for one week to be £14 14s. 6d., and by horse wagons for a like period £10 13s. 1d., showing that the cost of collection by motor exceeded that of collection by horses by 32·8 per cent. This approximates very nearly with the figures resulting from the month's trial, and makes a very useful additional test. If we had weighing machines at the different depots and tips, I should have been able to have given you more exact figures. The above results were obtained by weighing a given number of loads, and taking their weights as the average per load of the remainder, and although not absolutely exact, the weights arrived at are quite sufficient to give a very near approximation as to the relative cost of collection by the two methods.

"The conditions under which the motors are worked in Cardiff is not advantageous to their economical use, for the following, among other, reasons: The time taken up in parading the streets while collecting the refuse is largely a waste of time, and as the distance from the collecting ground to the tips is not great, the motors have no opportunity, in travelling to and from the tips, of making up by their greater speed for the time lost while collecting.

"Each motor is fitted with a wagon body, and in addition draws two trailers, so that it is always drawing two wagons in addition to the one loading, and the train (if it may be called so) has to travel about three times the mileage that horse wagons have to; consequently the wear and tear is proportionately greater, in addition to which the turning, shunting, and coupling up, and the higher speed at which they travel to and from the tips, all induce to the increased wear and tear of the plant over horse wagons. Again, the motor driver cannot assist in loading, as do the horse drivers, and therefore his wage is an entire extra to that of the horse wagons; in addition to which, on account of the heavier work with the motors, the motor ashmen are paid higher wages than the ashmen with the horse wagons.

"It is necessary in some instances to send a horse wagon into the districts worked by motors to pick up refuse in places which are inaccessible to the motors.

"The foregoing and other minor reasons, coupled with the greater initial cost of the motors and wagons, in my opinion, account for the motors not proving so economical. If the tips were several miles further away from the place of collection than they are, then I have no doubt the results would be very different."

Upon the presentation of this report I was instructed to go further into the matter with a view of reporting as to what in my opinion was the best means to adopt for the working or letting on hire, or otherwise utilising the motors to the best interests of the corporation.

I found some difficulty at the time in making a recommendation, as I was anxious to retain the motors in anticipation of finding useful and profitable work for them in the near future.

In the meantime, however, the dumping ground, which had been centrally situated and in near proximity to the cleansing depot, had been filled up, and a new tip had been secured 1½ miles further afield, and, consequently, on February 12, 1907, I presented a further report to my committee, containing the following information and suggestions:—

"I beg to report that I have given this question very careful consideration, and I am still of opinion that the work the corporation motors are doing is not profitable, and the question arises as to what better service they could be put to, or as to whether they should be disposed of. Personally, I am averse to the disposal of the motors, because I hope that, if not at present, at any rate in the near future, profitable work may be found for them. For the present, however, my recommendations would be to take the motors entirely off the work of collecting refuse, and in future to do this work by horse power. The collections from the central and docks districts I would recommend should be brought to Trade-street depot, and that one of the motors be employed for running the refuse thus collected from Trade-street to the new tip near the Penarth-road toll gate; this process, I believe, would be found more profitable than the present method of procedure. The collections by horse power having been brought to Trade-street, the horses would be transferred to empty wagons there in readiness, and the full wagons coupled up to the motor and conveyed to the tip."

The suggestion contained in the last report was acted upon. The refuse from the area nearest the cleansing depot was collected in horse-drawn wagons and brought to the depot, where the horses were taken out of the shafts and attached to empty wagons in waiting and despatched on collecting work, while four wagons were coupled together and drawn to the new tip by means of a motor wagon acting as a tractor, but with no body load.

After this method had been in operation for some time figures were gone into, and it was found that the conveyance of the refuse from the depot to the tip by means of horse-drawn wagons cost 1s. 9d. per load, but the same work when done by means of the motors, as described, cost 1s. 4d. per load, which thoroughly justified the new use to which the motors had been put.

In using the motors for the collection of refuse it was found that there were one or two disadvantages from which they suffered—for instance, there were certain places which were not accessible to a motor wagon, and consequently a horsed wagon had to be sent to these inaccessible places.

Again, in the rapid collection which was attempted, the loading being done while the wagons were in motion resulted in an undue amount of refuse being littered on the streets, necessitating a large amount of additional cleaning up.

* Paper read at the annual conference of the Institute of Cleansing Superintendents, held at Cardiff.

Still another disadvantage was found on the tip, for the motor could not approach the edge of the tip, and frequently became embedded up to the axles, and took some getting out, while the load had to be cast out where the motor stuck and removed to the face of the tip by other means.

In placing these few particulars before you please do not imagine that I am desirous of condemning the use of motors, whether they be steam, spirit, or electrically driven, for cleansing or other municipal purposes. My only desire is to point out that previous to purchasing such appliances a public official should make sure that the machine to be acquired is suitable for the work it has to perform, and that its adoption will result in true economy, not only to the particular department for whose use it is to be applied, but to the council as a whole, for it should be an axiom of every public official that one department of a council should not benefit at the expense of another—that is not true economy. . . .

In conclusion, may I venture, after eleven years' experience in the running of steam motor vehicles, to say that I do not consider any motor vehicle suitable for work where the loads have to be discharged on to a dump, as at Cardiff, and that, in my opinion, the following essentials are necessary in order to secure economical running of motor vehicles —viz.:—

(1) Rapid loading.
(2) Full loads.
(3) Reasonably long distance to run.
(4) A suitable place of discharge.
(5) Quick discharge.

With these essentials motor vehicles will unquestionably prove more economical than horses; without, the results must be considered, to say the least, as very doubtful.

PERSONAL.

Mr. W. J. Tait, borough surveyor of Sudbury, who is in the Army, has been promoted to a captaincy in the Royal Engineers.

Mr. D. Macalister, water engineer to the Greenock Corporation, has had his salary raised from £275 to £300 per annum.

The late Mr. F. W. Lacey, borough engineer of Bournemouth, who died on March 24th last, left estate of the gross value of £21,181.

Mr. W. G. Melvin, municipal engineer, Howrah, India, has been elected a member of the Institution of Municipal and County Engineers.

Mr. C. R. Cole, assistant county surveyor, Somerset, has been elected an associate member of the Institution of Municipal and County Engineers.

Mr. W. G. A. Clark, assistant surveyor to the Loftus Urban District Council, has been elected a student of the Institution of Municipal and County Engineers.

Mr. W. Greenwood, engineering assistant, Swindon Corporation, has been elected an associate member of the Institution of Municipal and County Engineers.

Mr. J. T. James, chief assistant county surveyor, Herefordshire, has been transferred to membership of the Institution of Municipal and County Engineers.

Mr. J. Temple Robinson, assistant to the county surveyor, Somerset, has been transferred to associate membership of the Institution of Municipal and County Engineers.

Mr. F. W. Tillotson, deputy surveyor and inspector to the Elland Urban District Council, has been appointed surveyor and inspector to the Birstall Urban District Council.

Mr. H. S. Goodall, engineering and surveying assistant, Edmonton Urban District Council, has been elected an associate member of the Institution of Municipal and County Engineers.

Mr. S. W. Richardson, engineering and surveying assistant to the borough surveyor of Eastbourne, has been elected an associate member of the Institution of Municipal and County Engineers.

Mr. Robert Gordon, King's Lynn, has been appointed road surveyor and sanitary inspector for the Easter Ross district of Ross and Cromarty, in place of Mr. W. Wyllie, appointed to Dundee. The salary is £280 a year.

Mr. E. Percival Mackay, of Chiswick, has been appointed chief surveyor's assistant to the Romford Urban District Council, temporarily, at a salary of £3 3s. per week. The surveyor, Mr. H. T. Ridge, is at present seriously indisposed.

Mr. H. C. Fread, surveyor to the Esher and the Dittons Urban District Council, has been congratulated by his council on the satisfactory result of the purchase made on his suggestion some four years ago of about 7,000 yds. of ballast lying on the Metropolitan Water Board's land adjoining the sewage works. At that time the council were proposing to erect new tanks and filters at those works, and the surveyor was of opinion that a considerable saving would be effected in their construction by the purchase of the ballast. The whole of it has now been used, part in the sewage works and part in the council's general work, and the remainder sold. As a result the council have made a profit on the transaction of £701.

Mr. E. W. A. Carter, who, as stated in a recent issue of The Surveyor, has been appointed city surveyor and waterworks engineer of Gloucester, received his technical education at the Gloucester Municipal Technical Schools. In 1890 he was articled to Mr. J. Fletcher Trew, architect and civil engineer, Gloucester, and whilst with him was engaged upon works of water supply, drainage, sewage disposal,

Mr. E. W. A. Carter,
City Surveyor of Gloucester

public baths and public and private buildings and factories. After spending a short time with Messrs. Waller & Son, diocesan surveyors, he became an assistant to Mr. R. Read, Assoc.M.Inst.C.E., city surveyor and waterworks engineer, Gloucester. In 1898 he was appointed assistant city surveyor, and in 1908 deputy city surveyor, and was directly responsible to the council for the work of the city surveyor's department in connection with the streets, health and improvement committees. The time during which he has been connected with this department has been one of great activity, and Mr. Carter has been intimately associated with all the works carried out. He is a member of the Institution of Municipal and County Engineers.

OBITUARY.

Lieutenant J. L. Peacocke, surveyor and water engineer of Newtownards, co. Down, has been killed in action. He was a native of Norfolk.

Lieutenant J. Lindsay Brough, Royal Scots, a member of the Edinburgh city architect's staff, who was previously reported missing, is now reported killed.

Mr. David Maebean, an architect in the Glasgow Office of Public Works, died suddenly on Saturday at Kingussie. He entered the service of the Corporation of Glasgow thirty-nine years ago.

Mr. James Pryde, road surveyor of the Western District of Kirkcudbrightshire, died, we regret to state, on the 9th inst. He had previously served in the road surveyor's office at Dunfermline, and was married only a year ago.

Mr. Singleton Goodwin, county surveyor of Kerry, has, we regret to state, lost his only son, Lieutenant W. A. Delays Goodwin, who was killed in action. Lieutenant Goodwin, who was in his twenty-third year, obtained a commission in the Yorkshire and Lancashire Regiment, and was signalling officer to his battalion at the time of his death.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Axminster R.D.C.—With reference to the proposed isolation hospital it was reported that a committee had met a similar committee of the Lyme Regis Town Council, and had agreed that the town clerk of Lyme Regis should prepare a scheme.

Bradford T.C.—It is proposed to execute alterations at the Cartwright Memorial Hall, at an estimated cost of £240.

Burnley T.C.—The Local Government Board are being asked to sanction the purchase of Bank Hall and 13½ acres of land for the purpose of a maternity centre.

Clowne R.D.C.—The council are conferring with the parish council on the question of the provision of public conveniences.

Falmouth T.C.—Inquiries are being made with a view to providing a site for a smallpox hospital.

Kirkcaldy T.C.—The electrical engineer recommends the building of a new power station near the sea and railway.

Morecambe T.C.—A decision has been reached to purchase the Poulton Hall estate, covering nearly 3 acres, with grounds and buildings, for a new town hall and other municipal buildings. The site adjoins the technical school, the central schools, and the education offices.

Silsden U.D.C.—It has been agreed to defer the question of the erection of an abattoir until after the war.

HOUSING AND TOWN PLANNING.

Bristol T.C.—Application is being made to the Local Government Board for sanction to build twenty houses at Avonmouth.

Strood R.D.C.—With respect to the local housing schemes, which had been carried out under the auspices of the Admiralty, it was explained by the chairman, Mr. C. Lake, in answer to inquiries, that so far as he understood when the Hoo contract was taken, the Strood cottages were also before the Admiralty at £50 a house less than at the present time, but the Admiralty, through no fault of the council, delayed the whole thing for another three months, and when they did accept the conditions, the whole of the prices had gone up to such an extent that the builders refused to carry out the contract. Then the Admiralty offered them another £50 per house to get the work done. The actual cost was all paid by the Government, and, providing the council let the houses when they were completed at the price fixed by the Government, it would not be a copper of expense to the ratepayers. The scheme would most certainly pay for itself on the figures the council had settled with the Admiralty. The clerk mentioned that the original price of the houses was £215 per house; now it was increased to £292. The original contractor withdrew his tender owing to the large increase in prices.

Wallsend T.C.—The borough surveyor, Mr. G. Hollings, has received instructions to proceed with the town-planning scheme, and to obtain expert assistance if necessary.

MOTOR TRANSPORT.

Exmouth T.C.—A second-hand motor lorry has been purchased for £120.

Salford T.C.—It has been agreed to purchase four motor ambulances at a cost of £1,150.

REFUSE COLLECTION AND DISPOSAL.

Stonehaven T.C.—By a majority of one the town council have approved a recommendation of the Public Health and Cleansing Committee that only certain kinds of rubbish should be carted away by the municipal staff free of charge.

Whitby U.D.C.—The General Purposes Committee have been asked to consider the question of the collection and disposal of waste articles which might prove of economic value, including waste paper.

ROADS AND MATERIALS.

Argyll C.C.—A grant of £149 has been made to the Lorn District Committee towards schemes of road improvement.

Banchory T.C.—Sections of High-street and Raemoir-road are to be repaired at an estimated cost of £609.

Barnstaple R.D.C.—On the receipt of a petition from Braunton asking that a road should be tar-sprayed, members protested against men being kept on the roads when they were so badly wanted for the land. It was decided to ask the county council only to tar-spray portions of the roads adjoining houses.

Battersea B.C.—Estimates for £165 have been passed for repairs to Anhalt-road and Bridge-road West.

Bognor U.D.C.—Plans and estimate are being prepared for widening the corner of Gordon-avenue and Chichester-road.

Bridgend U.D.C.—Tar-spraying is to be carried out on Merthyrmawr-road, Quarella-road, and Cemetary-road.

Cardiganshire C.C.—In addition to financing certain road-tarring schemes the Road Board will contribute £943 towards the estimated cost (£1,886) of laying tar-macadam on the Llanbadarn road.

Doncaster R.D.C.—It has been intimated that the County Highways Committee have sanctioned a grant to the rural council of £658 towards the maintenance of the Great North road between Doncaster and Bawtry.

Dudley T.C.—It has been agreed to flag the north side of Hall-street, at a cost of £100.

Dumfries-shire C.C.—It has been intimated to the Dumfries District Committee that the Road Board will be prepared to sanction the full road development grant.

Ealing T.C.—A scheme is being considered for the widening of Broadway.

Hampton U.D.C.—A scheme has been approved for making up Upper Sunbury-road, at an estimated cost of £948.

Hove T.C.—The town council have approved of a proposal for the repair of part of Old Shoreham-road and Sackville-road.

Kirbymoorside R.D.C.—The surveyor, Mr. W. D. Rickaby, reported that the county surveyor (Mr. W. G. Bryning) had inspected the Welburn and Nunnington road which the rural council desired the county council to take over. He had stated that before he could agree to the road being taken over several parts would have to be strengthened, and the whole of the road resurfaced with whinstone. This would cost approximately £1,000. The matter was adjourned until the county surveyor's requirements had been definitely ascertained.

Llanidloes T.C.—A scheme has been sanctioned for the improvement of the river bank near the Smithfield, and at the front of the Britannia Inn.

Lyme Regis T.C.—Formal approval has been given to the scheme of the Dorset County Council for the construction of the proposed new road to Charmouth.

Newcastle-under-Lyme T.C.—The town council have received an intimation from the Road Board of a grant of £977 towards works of resurfacing, tar-spraying and Tarvia grouting.

Norwich T.C.—It has been agreed to accept the offer of certain owners in Recorder-road to make themselves responsible for the making up of that thoroughfare, at a cost not exceeding £1,600.

Orsett R.D.C.—The council have adopted the suggestion of the surveyor, Mr. F. T. Johnson, to make application to the Road Board for a grant towards the cost of tar-dressing the roads.

Rhyl U.D.C.—With respect to the sand-removal works the surveyor, Mr. A. A. Goodall, reported that during the preceding month the sand removed from the promenade and parade roads amounted to 1,648 cartloads. In accordance with instructions given at

the last meeting he had communicated with the contractors with reference to the rate of progress of the work of removing the sand from the Marine-drive, and the contractors pointed out the high winds had blown sand into the roadway as fast as it was cleared away. They also pointed out other difficulties not anticipated.

Woolwich B.C.—Complaint was made at a recent council meeting of the state of the roads, one member characterising the state of things as "diabolical," and another as "disgraceful and dangerous." Councillor Barefoot, while agreeing that the condition of many of the roads was disgraceful, reminded councillors that this was due to their own action. When the estimates were before the Works Committee the borough engineer brought up a scheme to put the roads into something like decent repair, especially those parts which were used for 'bus routes. Members of the committee also spent a good deal of time in inspecting the roads, but when the estimates were considered, the greater part of the money provided to put the roads in proper order was cut out, notwithstanding that at the time the rates were being reduced. The council agreed that the subject should be dealt with by way of report.—The Works Committee have accepted the tender of the Trinidad Asphalte Company, at 12s. per yard super., for resurfacing with asphalt a portion of Artillery-place.

SEWERAGE AND SEWAGE DISPOSAL.

Branston R.D.C.—As a temporary arrangement it has been agreed to construct two rising mains over the river at the end of Henley-street to convey the sewage from Boultham.

Clutton R.D.C.—The council are considering with the Bath Rural District Council the question of an adequate sewerage scheme for Camerton.

Rotherham T.C.—The Sewerage Committee have been asked to consider the question of the extension of the Lord-street sewer.

Stanhope U.D.C.—A proposal has been accepted for connecting the camp with the council's sewage works.

WATER, GAS, AND ELECTRICITY.

Bedford T.C.—Electricity mains extensions estimated to cost £1,300 are recommended by the Electricity Committee.

Castlereagh R.D.C.—A sub-committee has been asked to report upon the Cregagh water supply, with a view to the adoption of a proper system.

Cardiff T.C.—Referring at a meeting of the Tramways Committee to the probable effect of the restricted lighting and daylight saving on the revenue of the department, Mr. A. Ellis, electrical engineer and manager, said they were going to drop in revenue about £20,000 to £25,000—about 30 per cent on the total revenue. In the year ending March, 1916, the income from street lighting was £9,798. It was now down to £881, and their loan charges were £902.

Derby T.C.—Electricity mains extensions are to be carried out at an estimated cost of £1,500.

Grimsby T.C.—The deputy borough electrical engineer reported that since the Summer Time Act came into operation there had been a saving of about 12 per cent on the amount of current consumed for lighting.

Lynn T.C.—The balance sheet for the electricity works showed that the profit for the past year was £1,018, compared with £1,350 for the previous year. It was decided that the whole of the surplus be applied in reduction of capital moneys borrowed for electricity purposes.

Norwich T.C.—The profit earned by the electricity undertaking last year was £4,503. It has been decided to increase the charges for current by 5 per cent.

Salisbury T.C.—The city council have agreed to accept the tender of Messrs. Tangyes, Limited, Birmingham, for the provision of new pumping plant at the Wyndham-road pumping stations. It is proposed to borrow £4,200 for a term of twenty years at 5½ per cent.

Southend T.C.—The Highways Committee have been asked to consider the desirability of extending the use of electricity in street lighting.

Sunderland T.C.—It is proposed to re-cable the low-tension electric mains at an estimated cost of £530.

Wigan T.C.—A scheme has received approval for the enlargement of the Whitley reservoir, at an estimated cost of £629.

MISCELLANEOUS.

Bognor U.D.C.—With reference to the question of allowances to the dependents of eight of the council's employees recently called up for service under the Military Service Act, the council have decided, although those cases differ somewhat from those of the men who voluntarily attested previously, they would, if the Government separation allowance was less in any case than the man's former wages, make such an allowance, not exceeding 5s. a week, as would bring the full allowances up to the amount of such wages.

Scarborough T.C.—It was announced that the Board of Trade had sanctioned the carrying out of certain work of sea defence on the north side. Since that application was made further and somewhat serious developments have taken place on the Royal Albert-drive, and are causing the council considerable anxiety. The matter is under consideration, and will be reported upon.

Surbiton U.D.C.—The War Office having tested the council's steam fire engine, with a view to purchasing it, the chief officer of the brigade has been empowered to sell it at a price fixed by the Fire Brigade Committee.

FOR OTHER ADVERTISEMENTS
See End of Paper.

EAST BARNET VALLEY URBAN DISTRICT COUNCIL.
SEWAGE FARM MANAGER.

The Council invite applications from suitable persons, ineligible for military service, for the position of Manager of their Sewage Irrigation Farm and Disposal Works.

The person appointed will be required to reside in the house provided by the Council on the Farm, free of rent, rates and taxes.

The salary will be at the rate of £2 2s. per week, rising by annual increments of 2s. per week to £2 10s. per week.

Applications, stating age, experience and other qualifications, and whether single or married, must be sent to me marked outside "Farm Manager," not later than Saturday, 5th August, 1916.

Canvassing in any form will be a disqualification.

T. A. BUCKLEY,
Clerk of the Council.

Council Offices,
Station-road, New Barnet.
July 18, 1916. (3,051)

ELLAND URBAN DISTRICT COUNCIL.
ASSISTANT SURVEYOR AND SANITARY INSPECTOR.

Wanted, Assistant Surveyor and Sanitary Inspector. Commencing salary £140 per annum. Full particulars of the appointment and duties may be obtained from the undersigned.

Applications, stating age, qualifications, &c., to be sent to the undersigned not later than Wednesday, August 2nd, 1916.

JAMES CLARKSON,
Clerk to the Council.

Council Offices.
Elland. (3,052)

RUISLIP-NORTHWOOD URBAN DISTRICT COUNCIL.

The above Council invite Tenders for the following supplies, delivered at Northolt Junction (G.W. and G.C. Joint Station) or Ruislip (Metropolitan Station) respectively:—

700 tons Tarred Slag Macadam, at per ton.
600 yds. C. Hand-picked brick or good concrete Hardcore, 4½ in. gauge, at per ton.
Clean Clinker, not less than 2 in. gauge, at per ton.
Certain delivery must be guaranteed.

Tenders, sealed and endorsed "Tenders for Tarred Slag Macadam," or as the case may be, must be delivered to the undersigned not later than 1st August, 1916.

The Council do not bind themselves to accept the lowest or any Tender.

EDMUND R. ABBOTT,
Clerk to the Council.

Council Offices,
Northwood, Middlesex.
July, 1916. (3.050)

Results Obtained by Electric Vehicles in the Removal of House Refuse.*

By J. TERRY, Cleansing Superintendent, Nottingham.

Having given much thought and consideration to the various papers relating to motor traction given at our conferences during recent years, I had decided that motor vehicles were not suitable to the peculiar conditions which prevailed in Nottingham.

Many of you will no doubt remember that our conference last year synchronised with an exhibition organised by the Road Board at the Horticultural Hall, where vehicles of various descriptions were displayed, and it was there I saw the first electric vehicle, with which I was very much impressed. From the information then received, and from my previous knowledge, I summed up the advantages and disadvantages of the various vehicles as follows:

PETROL-DRIVEN VEHICLES.

Advantages.	*Disadvantages.*
Moderate capital cost.	High running costs.
High speed.	Proved inability to withstand constant starting and stopping.
	High maintenance costs.
	Heavy tyre expenditure.
	Dear fuel. Fluctuating price of same.
	Many working parts.
	Motor running while vehicle stands.
	Noisy on low speeds.
	Skilled drivers needed, and special maintenance staff.

STEAM-DRIVEN VEHICLES.

Advantages.	*Disadvantages.*
Moderate capital cost.	Constant wastage of power when standing.
Satisfactory speed.	Skilled labour to manage, and then two men required.
Cheaper fuel.	Costly maintenance.
Satisfactory starting and stopping.	Heavy tyre expenditure.
	Frequent loss of earning power during overhaul.
	Fear of boiler troubles.
	Noise—steam exhaust offensive.

ELECTRIC.

Advantages.	*Disadvantages.*
Ample speed.	High capital cost.
Ability to withstand starts and stops.	Low speed.
Very rapid acceleration.	
Few moving parts, therefore low maintenance.	
Cheaper tyres (initial cost).	
Less wear on tyres owing to easy turning movement.	
Cheap fuel at fixed prices.	
Ease of control, therefore horse men prove successful drivers.	

By employing the electric there would be no noise, odour, smoke, gears to change, no clutch, no carburettor to adjust, no ignition troubles, or no boilers to overheat; therefore I could not fail to lean towards this vehicle, which had to be used on the heaviest possible work, with a staff whose engineering experience was, to say the least, modest.

HEAVY INITIAL COST.

While I favoured the electric vehicle, I did not approve its high cost, and did my utmost to obtain a reduction. I found that the manufacturers, although keenly competitive, were unable to reduce their charges, the reason for this being that the output of electric vehicles is very small compared with other types of vehicles. The works costs must therefore remain high until the demand grows. Added to this, the high cost of freight and insurance brings about a total which appears very heavy compared with the purchase price of petrol and steam vehicles. I also found that the British-built chassis were not cheaper, and therefore I had to consider the vehicles available on their merit at their present prices. I found that users had experienced little or no maintenance, and that the claim that an "electric" was good for a life of even so much as fifteen years, without undue maintenance, was likely to prove true. This materially simplified the proposed initiation, with the result that I advised my committee to make an immediate experiment, which suggestion was promptly acted upon.

I then decided that I needed vehicles of 3-ton capacity, but I have since seen that a mixed fleet of 2 and 3 tonners working in pairs of equal capacity will be ideal for the convenience of our town. The body must be of sufficient cubic capacity to carry the load under average conditions, but no concern need be felt when the weight per cubic yard exceeds normal, as no vehicle of good design should be strained under the occasional maximum conditions.

High speed would be no advantage, for when working in pairs the maximum speed required is governed by the speed of filling. (It would obviously be a fallacy to accelerate speed if the empty vehicle has to wait while the second vehicle is nearing the completion of loading, and alternatively the capacity of body is governed by the distance the loads have to be taken. A speed of from 9 to 12 miles per hour is ample.

It was essential that, whichever power was selected, the vehicle must be capable of starting and stopping upon all levels and conditions of road without causing undue maintenance. The simplicity of the mechanism convinced me that the "electric" would excel in this respect.

BATTERIES.

The next and more difficult point to decide was the selection of battery. When I first mentioned electrics to my chairman he opposed the idea, on the ground that his experience of them was not satisfactory. I replied that I was not surprised, as undoubtedly he had been using lead batteries, and as this may have been the experience of others I trust you will excuse me if I appear to dwell somewhat on this point.

I do not pretend to be an electrical engineer, but I have friends whose advice is worth seeking. Upon hearing my requirements they sagely shook their heads and gave me many hints on the upkeep of lead batteries, which were of a more or less bewildering nature. I then chanced to meet with a pamphlet describing the upkeep of a traction lead battery. The following is a part of the article in brief outline: "All positive plates slowly disintegrate during their working life, though, as will be shown later, the rate of disintegration is largely controllable by the user, depending upon the care exercised in avoiding free and violent gassing in the course of charging the battery. But, slowly or quickly, the process of shedding the active material goes on, and unless ample space is provided for the reception of material so thrown down, it will soon accumulate to a level where it touches the plate, when it 'short circuits,' or, in other words, makes a circuit inside the cell. Unless the cells be immediately cleaned out—and this involves time as well as a certain amount of skill and expense—the plates will soon be ruined."

I need hardly state that such precaution seemed difficult when the nature of our work was considered, and it was a considerable relief to find upon examination that the "Nickel Iron Accumulator" battery was free of weaknesses such as have been described. I agree that the imperfections of the lead battery may be more aggressive when explained in cold print than when handled by skilled electricians. I had to remember that skill in handling does not end the care necessary for successful maintenance. Much harm can be done to the battery by careless discharge, and temporary short circuit, if not absolutely disastrous with some types of lead battery, at least causes inconvenience, and may entail its removal from service. This would necessitate spare sets and special appliances for the easy removal of approximately ¾ ton of cells by the means of lifts, jacks, trucks and similar contrivances.

Obviously in this class of service it is essential to have the battery dust-proof and mechanically strong. This you will agree is even more necessary than very high efficiency, for current is cheap, whereas battery maintenance is expensive. In the nickel iron battery I believe we have a battery which is almost indestructible within a reasonable service. Certainly the manufacturers believe in its longevity, for they have formulated a special guarantee which states that on the completion of 60,000 miles service the battery will still show its original rated capacity, failing which, they will at their discretion bring the cells within the specification, or replace same free of charge. This guarantee is subject to certain con-

* Paper read at the annual conference of the Institute of Cleansing Superintendents, held at Cardiff.

ditions as to maintenance, which are simple to follow and offer no loophole whereby the terms of the guarantee can be avoided.

As the mileage per day on refuse collection is from 15 to 22 miles, the average can be taken at 20 miles per day, which represents at 300 days per annum a ten years' guarantee. The manufacturers stipulate that the maximum period of the duration of the guarantee is eight years. It is comforting to know that, notwithstanding this shortening of the actual period of guarantee, "service" is the destroying factor not "idleness." Since there are many instances where Edison batteries have much exceeded 100,000 miles service in heavy-draught vehicles, it seems probable that the capital write-off at 10 per cent per annum is much too conservative. At this rate of reduction of value the vehicles successfully carry out the work at a price hitherto unheard of with horse traction; therefore it is wise to retain the figure and benefit at a later date should my calculations prove too pessimistic.

The cost of the best type of lead battery is about half that of the nickel iron. Certain makes carry no guarantee whatever, but for a fixed sum per mile a battery maintenance can be arranged. Other makes are guaranteed for a minimum of 20,000 miles. In the event of this mileage not being completed, then a new battery is equipped at a reduced cost proportionate to the lost mileage. That is to say, if 15,000 miles only is completed, then the replacement will cost 75 per cent of a new one, subject to the fluctuations of the metal market.

COST OF CURRENT.

The guarantee of the nickel iron battery has been already stated, and from a business point of view I can, without any highly technical knowledge of electricity, appreciate the fact that on guarantees the nickel iron battery is undoubtedly much superior and more conclusive. Then comes the question of efficiency. The cost of current at 1d. per unit (which is the almost universal charge for traction current, but, unfortunately, not so in Nottingham) will average approximately 2s. per day. What is the difference of 10 per cent in efficiency? This is the admitted advantage of the more efficient lead cell. I repeat, what is this small charge compared with the much higher maintenance costs? I doubt if the difference will cover the loss and inconvenience occasioned by the vehicle being out of commission while the lead batteries are being periodically overhauled and defective plates being replaced.

While on the point of cost of current it is well to remember that where destructors are available so can electricity usually be found, or the necessary plant be installed at a cost not affecting the proposition whatsoever.

The makers of the Edison battery give me the following description of the construction of the nickel iron battery: The Edison battery is composed of a number of steel plates contained in corrugated nickel steel containers. The positive plate contains alternate layers of nickel hydroxide and pure flake nickel, this material being supported in spirally made steel sheaths, the edges of which are overlapped, the whole being submitted to a very high pressure during filling, rendering the contents to a rock-like nature. These are further encased with a number of small steel rings. These pencils are supported in frames made of the same material. The negative plate consists of a number of perforated steel pockets containing iron oxide, similarly supported. The opposite poles are supported by pure rubber strip sheets and frames in a concentrated form, the heavy cost of which, I understand, is largely responsible for the high cost of the cells.

The electrolyte is non-acid, and is composed of a solution of lithia and potash. These ingredients are interesting, insomuch as it is known that potash is a preservative to steel; all the metal parts being of steel, it is probably due to this fact that the long life of the plates may be confidently anticipated.

With regard to maintenance, so far no cost has been involved, but a small sum of money has been set aside to ward against possible expense at a later date. It is usual to add distilled water to each cell by means of an automatic device two or three times per week, depending upon the climatic conditions. The frequency of these operations is regulated by the amount of evaporation. The filling device indicates whether the cell requires more water, by means of a bell or buzzer, which is vibrated when filling is normal. This process occupies from six to ten minutes, and is carried out by unskilled labour. The exterior of the containers is submitted to a bath of nickel, and afterwards painted with an insulating paint known as Esbalite. It is important that cleanliness be observed, and that the cells be regularly repainted should the original coating of Esbalite have flaked off, which is sometimes observed. These precautions are taken with a view to preventing rust, and negligence in this direction may cause leakage to the containers which cannot be repaired, but must be replaced. The replacements of the cans will not destroy the value of the plates, and while the expense is little, such a debit need not be incurred provided ordinary precaution is taken. The Edison battery is totally enclosed, the filling aperture being provided with an ample cap in which is contained a ball valve which prevents foreign matter from encroaching. At the same time it breaks the globules of electrolyte. These are thrown up in an effervescent form during high rates of charge and discharge, and are thus returned to normal useful condition.

WORKING COSTS.

In the report presented to my committee in September last I submitted estimates from the makers of various vehicles and the results of special tests made at Barnes, Heston and Isleworth, Dover and Sheffield, which figures I can supply if desired; but as we now possess figures covering a fairly long period under normal working conditions I think these are preferable.

During six months ending July 1, 1915, the cost of emptying dry ashbins by horse vehicles in Nottingham averaged 4s. 4d. per ton, but owing to the increased charges for horse-keep, wages, &c., the cost is now 5s.

Our No. 1 motor was delivered on October 15, 1915, commenced work on the 18th, and has been in use daily ever since. During the six months ending April 15th it carried 422 loads, weighing 1,288 tons, at a cost of £241 13s. 10d., which is equal to 3s. 9d. per ton, the average weight per load being 3·05 tons.

The costs are made up as follows:—

	£	s.	d.
Depreciation at 10 per cent	52	13	0
Insurance	4	5	0
Oil, water, repairs, &c. (allowed) ...	11	9	8
Tyres—1,819 miles at 1·1d.	8	6	9
Current—2,541 units at 1¼d.	13	4	8
Wages	151	14	9
	£241	13	10

If we take the six months ending July 1, 1916, we get a period corresponding to the period covered by the figures given in my original report, and this is a more fair comparison than taking the first six months' work, which are all winter months. We find that during this time we removed 1,167 tons of refuse, at a cost of £253, or 4s. 4d. per ton, which is exactly the same as the cost by horses, as mentioned in my original report; but it must be remembered that the conditions then were the same as before the war. Under existing conditions, as I have already stated, the cost is 5s., thus showing 8d. per ton in favour of the motor, which means that if all our dry-ash refuse were removed by motors a saving of over £1,000 per annum would be effected, and this in a town which I consider not best adapted to motor traction for this class of work. I have dealt only with the results obtained by our No. 1 motor, but the figures for the No. 2, which has been at work daily since March 13th, are identical.

Mr. Priestley, cleansing superintendent, Sheffield, whose experience of electric motors in the collection of house refuse is greater than that of any other superintendent, recently presented a report to his committee, from which I have pleasure in submitting the following figures:—

No. 1. Vehicle.—Day Work Costs for twenty-two weeks.

Refuse collected, 858 tons, 6 cwt. 1 qr.

	£	s.	d.
Wages	154	15	8
Vehicle costs	40	7	1
Electricity, 3,269 units	13	12	5
Tyres, 2,168 miles	9	0	8
	£217	15	10

Cost per ton, 5s. 0·8d.

Cost of one month's work on same districts with horse labour:—

Refuse collected, 167 tons, 19 cwt., 2 qrs.

	£	s.	d.
Cost	59	1	9

Cost per ton, 7s. 0·4d.

No. 1 Vehicle.—Night Work Costs for twenty-one weeks.

Refuse removed, 1,142 tons, 19 cwt., 1 qr.

	£	s.	d.
Wages	72	3	8
Vehicle costs	38	10	5
Electricity, 2,927 units...	12	3	11
Tyres, 1,880 miles	7	16	8
	£130	14	8

Cost per ton, 2s. 3·4d.

Cost of three months' work on same districts with horse labour:—

Refuse removed, 473 tons, 11 cwt., 2 qrs.

	£	s.	d.
Cost	77	10	3

Cost per ton, 3s. 3·2d.

No. 2 Vehicle.—Day Work Costs for six weeks.

Refuse collected, 314 tons, 4 cwt., 3 qrs.

	£	s.	d.
Wages	47	10	5
Vehicle costs	10	19	3
Electricity—670 units	2	15	10
Tyres—417 miles	1	14	9
	£63	0	3

Cost per ton, 4s. 0·1d.

Cost of one month's work on same district with horse labour:—

Refuse collected, 204 tons.

	£	s.	d.
Cost	38	16	0

Cost per ton, 3s. 9·6d.

No. 2 Vehicle.—Night Work Costs for six weeks.

Refuse removed, 406 tons, 13 cwts., 2 qrs.

	£	s	d
Wages	21	18	0
Vehicle costs	10	19	3
Electricity—758 units	3	3	2
Tyres—459 miles	1	18	3
	£37	18	8

Cost per ton, 1s. 10·3d.

Cost of one month's work on same district with horse labour:—

Refuse removed, 440 tons, 8 cwts.

	£	s.	d.
Cost	55	10	2

Cost per ton, 2s. 6·2d.

Mr. Jackson, cleansing superintendent, Birmingham, who has been working an "Orwell" dust van since May 29th, reports that it is equal to 2·5 horses.

Even if the running costs and standing charges of motor vehicles are only equivalent to the present cost of horse collection, I most strongly contend that from a sanitary point of view the change is to be recommended. I feel personally that too much emphasis cannot be brought to bear on what appears of national importance, for the following among many other reasons which no doubt will occur to you:—

(1) Cleanliness of street.

(2) Labour provided for building chassis in this country.

(3) Reducing the demand for fodder and cereals for horses.

(4) Correspondingly increasing the supply available for feeding cattle.

From a hygienic standpoint the value of No. 1 alone compels us as cleansing superintendents to be in the front rank in adopting this improved form of traction.

In conclusion, it is worthy of mention that my faith in the success of electrics is upheld by many other municipal officials who with myself have franked their good opinion by placing orders and repeat orders as follows: Edison Battery Vehicles.—Sheffield, 5; Chester, 4; Dover, 6; Barnes, 4; Glasgow, 2; Pontypridd, 2; Newcastle, Heston and Isleworth, South Shields and Smethwick, 1 each. Lead Batteries.—Birmingham, 2; Wolverhampton, 1. In many cases reports have been made, in each of which substantial savings have been shown.

Glasgow's New Park.—A new park for Glasgow, at the confluence of the river Leven and Loch Lomond, was opened recently. The Balloch estate, as it is called, is 20 miles by road from the heart of the city, but by rail it is within easy reach of the community. The area which it is intended to use is approximately 200 acres.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάνθ' ὁρᾷ

(One man does not see everything.)

—Euripides.

PUBLIC ABATTOIRS.

To the Editor of The Surveyor.

Sir,—In the paper which he submitted at the recent annual meeting of the Institution of Municipal and County Engineers, Mr. H. A. Brown is very scathing in his comparison of the position this country occupies with that of Continental nations in regard to the provision of public abattoirs; but surely he overstates his case when he says that, "with the exception of one or two of the more modern erections, there is not a single abattoir in Great Britain which can stand comparison with the slaughter-houses in either France, Holland, Switzerland, or Germany." There are, in addition to those he names at Edinburgh and Belfast, many other public abattoirs in this country fitted up with every modern convenience and in every way fit to compare with Continental abattoirs, so far as sanitation and convenience are concerned. At the same time it can readily be admitted that private interests and public apathy have combined for too long to stand in the way of a more general adoption of public abattoirs, and the granting of the necessary powers to close all private slaughter-houses.

Mr. Brown's remarks upon the status of the abattoir superintendents on the Continent are interesting, but it is hardly likely that Englishmen will ever regard their officials with the same awe as Continental nations do. Nor is it likely that the officials of this country will ever decree that they should be saluted in the manner that every uniformed official on the Continent demands as due to his office.

Mr. Brown gives plans in his paper of an English abattoir for a town of 60,000 inhabitants costing £7,000, and one of a German abattoir for a town of 20,000, costing £18,000, which he asks us to compare presumably to the disadvantage of the English building. A careful comparison of the plans fails to show any grounds for this disparagement, especially if we take, as English surveyors are bound to take, the difference in cost into account. We pride ourselves on being a practical race, and it must strike most people as absurd to slaughter cattle in "palatial buildings in attractive surroundings, with shrubs, trees or grass plots introduced wherever possible, every wall in the place glazed internally, and marble slab lairages." "Palaces for pigs" hardly strikes a common-sense Briton as a practical proposition; and the bar or beer hall found in German abattoirs would have little prospect of being run here at a profit in these days of public control and abbreviated opening hours. Most people would expect the beer hall to have a tendency to make the butcher less careful in killing, and to show less of that humanitarian spirit which the adoption of public abattoirs should promote. Our recent experience of the German does not lead us to place much faith in his humanitarianism, and it is probably the spirit of the "gourmand" rather than the "humanitarian" which prompts him to erect such imposing and costly buildings. Mr. Brown says that there is not a single public abattoir in Germany which is not self-supporting, which is certainly not the case in this country, but rather the exception. The statement, however, on examination is found to be not so disquieting as one might suppose at a first glance. With regard to the size of the buildings and their success financially in Germany, it must not be forgotten that the character of the meat supply differs very considerably from our own. It is well known that the agrarian party in Germany have great political power, and have always aimed at the prohibition of imported foods by means of high tariffs. As Mr. Brown points out in his paper, we find the reverse of this in this country, where in some of our large towns 80 per cent of the meat is imported dead, and only 10 per cent killed in public slaughter-houses. This largely explains the reason why our slaughter-houses are so much smaller than the Germans', and the reason why they are not self-supporting is to be found in a comparison of the charges made in this country with those abroad. The charges made for killing beasts and pigs in the German towns is shown by Mr. Brown to be five to six times higher than those in force at Weston-super-Mare, which again are not the lowest in this country. If the same conditions

applied in this country, by which everyone was forced to kill publicly, and the same or heavier charges were levied in the case of imported meat, as in Germany, British authorities would be able to make their public slaughter-houses pay their way at half the charges levied by their Continental competitors.

That this is so may be seen by comparing the plan of the German abattoir with that for Weston-super-Mare. Mr. Brown says his design is purely Continental, but, if so, it differs very considerably from the typical German plan he gives in his paper, and which he says is in Germany "considered applicable to every conceivable set of conditions." It follows much more closely the plan of the Brighton abattoirs, which were erected over twenty years ago, than the German plan, and is in every way a great improvement on the Continental plan. While both the Weston and German plans show an open space between lairs and slaughter-hall, that at Weston is only 10 ft. wide and very convenient, whereas the other plan makes it necessary for beasts and sheep to travel some 65 to 160 ft. from lairs to killing room. Mr. Brown has not considered any separation necessary between the pig pens and killing room, and the scalding room is apparently not disconnected from the cooling room. On the other hand, the German plan insists on making the pig travel in the open from 65 to 125 ft., then go through a scalding room to reach the killing room. Though unable to share Mr. Brown's thoroughgoing admiration of Continental methods, their many good points are readily admitted, and there can be no question that Mr. Brown's paper is a very valuable contribution to an important branch of the municipal engineer's work.—Yours, &c.,

BRITISHER.

July 17, 1916.

MUD AS A BUILDING MATERIAL FOR COTTAGES, &c.

To the Editor of THE SURVEYOR.

SIR,—Your correspondent, "Excelsior," in last week's issue of THE SURVEYOR, when advocating the use of mud as a building material for the erection of workmen's cottages, states that "as an English nation (by which I presume he means the British nation), we are very slow in moving out of our usual groove, which is often detrimental in many ways to our advancement." Are we to infer from this that the building of cottages for workmen with mud would be an advancement? As a matter of fact, even the Indians, who for generations have, owing to sheer poverty, built their cottages with mud, are now using brick concrete and other such material, and there can be no doubt that as nations have advanced they have left the mud-hut behind. Are we to assume that our nation is now so poor that we are compelled to come back to the dark ages and house our workmen in such erections as "Excelsior" suggests. Surely our social progress in housing reform has not got such a set-back?

"Excelsior" says: "Surely if it is possible to cheapen the erection of cottages or other buildings by the introduction of mud as a building material we should endeavour to use it." His sole aim seems to be cheapness, which in the end is very often the most expensive. "Excelsior," however, seems to forget that the external walls of the cottage is only a small part of the total expenditure—about one-sixth of the whole—so that even although he constructed his walls of paper, he is left with the problem unsolved.

Perhaps "Excelsior" would do well to define his position and let us know whether he is for or against the improvement of the housing conditions of the working classes.—Yours, &c.,

PROGRESS.

July 17, 1916.

THE INSTITUTION MEETING AT BLACKPOOL: ORPHAN FUND.

To the Editor of THE SURVEYOR.

SIR,—I very much regret that at the annual meeting recently held at Blackpool no collection was held on behalf of the Orphan Fund.

Although this omission occurred, I trust those who attended will send what they would have then given direct to the hon. treasurer, Mr. O. Claude Robson, Municipal Offices, Dyne-road, Kilburn, London, N.W., and so prevent the poor kiddies from suffering through this oversight.

I have already sent my mite, and hope my fellow members will do the same.—Yours, &c.,

FRANK MASSIE.

Tetley House,
Wakefield.
July 17, 1916.

ROAD MAINTENANCE IN NORTHAMPTONSHIRE.

In 1913-14 the motor omnibus made its first regular journey on some of the Northamptonshire main roads. During the past two years other 'bus routes have been opened up, and there has been a large increase in heavy motor tractors and commercial vehicles. "Many of the roads," says Mr. Chas. S. Morris, the county surveyor, in his report for the year ended March 31st last, "are not only unsuitable in construction, but are far too weak to carry motor-'bus and heavy-motor traffic, and until they are strengthened and resurfaced it becomes increasingly difficult to maintain a good surface. Patching with tar-binding or tar-macadam overcomes the difficulty for a few weeks, but this method is both costly and unsatisfactory, as the remainder of the road rapidly wears away around the patches and the surface becomes a series of humps and holes. The only remedy is strengthening and reconstruction, but under existing conditions this is impracticable, except to a limited extent, and consequently the public must be prepared for further deterioration and worse roads until the end of the war. With the return of the men (more than 50 per cent are now in H.M. Army), and the normal supply of materials, an increased effort will be necessary to bring the roads to a surface and condition sufficient to successfully carry the heavy motor and 'bus traffic, but this will necessarily entail a very large expenditure on many of the roads."

COST.

During the past year the total expenditure on maintenance (exclusive of improvements and Road Board works) was £19,294 gross and £18,930 nett. Improvements (including repayments of loans) cost £1,172 gross and £1,006 nett. The expenditure upon Road Board works amounted to £26,502 gross and £12,987 nett, the latter being the nett cost to the county for the year.

The total cost was £46,968, and the nett expenditure for the year £32,924.

The total cost amounts to £147·75 per mile, and the nett cost to the council £103·57 per mile.

The estimated expenditure for the current year is £42,565 gross and £37,407 nett, or £133·90 and £117·68 per mile respectively.

On the 281½ miles of roads directly maintained, the cost of maintenance (exclusive of Road Board work) was £45·74 per mile gross, and £44·45 per mile nett.

SURFACE-TARRING AND TAR-BINDING.

Surface-tarring was carried out on nearly 72 miles of road, the area treated being 580,190 sq. yds. The total cost was slightly over £3,596, representing a cost per super. yard of 1·48d.

Mr. Morris gives the following particulars of tar-binding work (exclusive of 'bus routes) partly carried out in 1914, and completed in 1915: Length treated, 9·81 miles; area treated, 109,554 sq. yds.; metal used, 12,039 tons; chippings used, 1,428 tons; total cost of grouting, £3,005; cost per ton of metal treated (excluding chippings), 4s. 11¾d.; cost per yard super., 6·58d.; average thickness of coating, 3·09 in.

Timber, Plywood and Woodwork.—We would direct the attention of our readers to the double-page advertisement of Messrs. C. Jennings & Company, of Pennywell-road, Bristol, which appeared in our issue of last week. The information given in the advertisement should be of the greatest value to all users of timber, plywood or woodwork. We understand that the firm are prepared to answer any questions relating to the materials of which particulars were supplied, or furnish prices delivered to any part of the world, either of goods mentioned in the announcement or of others not included in it. They inform us that they hold stock at their branches and warehouses at Porthcawl (South Wales), Leyland and Pembroke Dock, Leicester, Swansea, Hull, Liverpool, Manchester, Newcastle and other places, and will be pleased to receive inquiries.

The Surveyor

And Municipal and County Engineer.

Vol. L. JULY 28, 1916. No. 1,280.

Minutes of Proceedings.

Roads.

The two papers on Roads by Messrs. Arnall and Schofield, which were read at Blackpool, deal with the subject from different points of view. Both papers have a very practical interest for surveyors, who cannot hope to construct good roads unless they fully appreciate the causes which make for their destruction, and take into account the change in the character and volume of present day traffic. Mr. Arnall's paper—which is reproduced on another page—was of a somewhat unusual type, and for that reason was all the more interesting. The author was able to express in scientific language the results of his long experience with regard to the damage to roads. It is the clear and graphic manner in which he states well-known facts, equally with the valuable deductions which they enable him to draw, that make his paper one of the most interesting and useful contributions ever presented to the institution. There may be some difference of opinion with regard to the extent of surface wear and internal attrition; but the importance of maintaining a smooth road surface, of sealing it so as to exclude all water, and of laying a sufficient depth of material so as to spread the pressure over a greater bearing area, is admitted by all practical surveyors.

That a large amount of interstitial wear takes place is proved by the rounded condition of the stone found when a macadam road is scarified. At the same time it is evident that as the depth increases this wear is very much less, and this, as shown by Mr. Arnall's diagram, is due to the area of the bearing cone becoming larger. Whether a depth of 10 in. is sufficient to prevent this interstitial wear will depend to a very great extent on the weight of the traffic and the character of the tyres. Internal attrition is considerably less when the stone is embedded in and held together with cementing material of a bituminous character. Not only do tar and bitumen fill up the interstices in the road better, but they provide a resilient cushion which absorbs the shock on the surface. The importance of using various sizes of stone so as to prevent voids is clearly pointed out by Mr. Arnall, and this is now becoming very generally recognised. The mischievous effect of water is more apparent in tar-macadam than ordinary macadam. While dampness, as Mr. Arnall observes, is necessary in an ordinary macadam road, wetness, on the other hand, destroys the cementing properties of the binding material, and there is little or no tension between the particles. Water is particularly destructive to stones with much clay in their composition, and clay subsoils or clayey binding materials always lead to trouble. The greasy nature of the clay causes movement in the roadway under the weight of the traffic, and leads to unevenness of surface and corrugation. If the tar in a road is not strong and of a pitchy character, or is used in too great quantity, the effect is somewhat similar to that of wet clay. Corrugation and wave action is generally much more pronounced in tar-macadam roads than in ordinary macadam.

The subject of potholes in roadways is very important. Soft places occur in most roads, and a series of holes frequently develop where there was every ground for believing the surface would keep good for a considerably longer time. There is no doubt that most potholes are started by the action of horses' hoofs, though weakness in the road is generally a contributory cause. Small stones do not stand so well as larger ones, and give way easily to the iron-shod hoofs of horses, or where they have worn in a hollow to the hammer-like action of wheels dropping into the hollows, and the upward bump that occurs when the wheel rises from the hollow, and the drop to the normal which converts the bump into a jolt. The friction caused by rubber tyres is very great, and Mr. Arnall is of opinion that loose stones are "shaken" out rather than "sucked" out of the ground by rubber tyres. Motor 'buses by their similarity of structure and speed do more harm to the roads than their weight and number would account for, and it is the uniformity of the action which leads to an accumulation of effects in the same spot which causes the trouble from motor 'buses.

* * *

Improvements of Highways.

Mr. Schofield's paper on "Improvements of Highways to Meet Modern Traffic" called attention to the great increase in the number of heavy mechanically propelled vehicles, due mainly to the commandeering of railways and horses for war purposes by the Government. Most of the heavy motor vehicles being manufactured by makers in this country at the outbreak of the war were taken by the Government, as well as a large number of privately owned motor vehicles, and a great number of those built since are still being taken for the same purpose; yet, as Mr. Schofield points out, on many of his main roads the number of these heavy motor vehicles is now 60 per cent more than it was when the war commenced. On the Manchester and Liverpool main road the increase during the past five years has been sevenfold. This extra weight is particularly severe on the rural main roads, as they now carry much heavier loads, travelling at higher speeds, than at any previous period; and as speeds are restricted in towns the losses are made up in the rural areas. The need for strengthening these rural roads, which in many cases have very poor foundations, is very great; but, unfortunately, the cost of reconstruction is also very great. Mr. Schofield estimates the cost of providing a hand-pitched rubble foundation with a coating of 4-in. tar-macadam and a 5-in. by 12-in. gritstone edging as being for the 350 miles of rural main roads nearly £2,000,000. Spreading the payment over ten years, this would give a yearly cost of £686 per mile, apart from all cost of maintenance. In the rural districts it has been found

only possible to strengthen the sides of the roads with a narrow width of hand-pitched rubble, and by giving a coat of 1 in. to 4½ in. of tar-macadam, at a cost of £3,200 per mile. In the southern portion of Lancashire there are twelve large county boroughs and fifteen non-county boroughs, and the main roads which link them up carry a very heavy commercial traffic. This is particularly the case where the towns are near to the docks at Manchester and Liverpool. The local millstone setts which were formerly used in most of these districts have been found quite inadequate to cope with the heavy motor vehicles in use to-day, and granite setts on a concrete bed have been very generally adopted as being the most economical form of paving. Where the heavy motor traffic calls for the provision of new foundations, Mr. Schofield is of opinion that concrete foundations with granite or wood paving should be used. In the discussion on this paper several speakers called attention to the damage done to granite setts by the iron-shod wheels of heavy motor vehicles, especially when laid on a concrete foundation. A more resilient foundation, such as that provided by a layer of ashes or tarred chippings, appears necessary to prevent the edges of the setts being spalled under heavy traffic.

Mr. Schofield has found that tarred iron slag has been the most successful surfacing material for rural main roads, and that tarred granite has not been uniformly successful. Tar-grouting he has abandoned in favour of tar-macadam, on account of the latter being cheaper and less subject to adverse climatic conditions. As is generally the case, a difference of opinion found expression in the discussion with regard to the use of tarred granite and tarred slag. Mr. Finch, the county surveyor of Cumberland, prefers granite to slag for tar-macadam, while Mr. Hadfield finds slag best at Sheffield. Its use appears to be largely a question of cost, for while Sheffield and Lancashire have numerous convenient slag heaps, and no granite quarries, Cumberland, on the other hand, has many fine granite quarries. The use of granite mixed with tar of the proper consistency, in the hands of an experienced man will give good results; and where failures are met with it is not the stone that is to blame, but the quality of the tar, injudicious mixing, or geological or geographical drawbacks in the shape of clay subsoils or damp situations.

* * *

Motor Traffic Over Railway Bridges.

On Friday last judgment was delivered by the House of Lords in the case of the *Attorney-General* (on the relation of Pickfords, Limited) v. *Great Northern Railway Company*, which raised an important question as to the condition of strength in relation to traffic in which the company were bound to maintain a railway bridge built over a public highway under the powers of a special Act which incorporated the Railways Clauses Consolidation Act, 1845. The point at issue was as to whether the liability of the company as to maintenance was limited to maintenance in a condition fit to bear traffic of the kind existing when it was constructed in 1867, or whether they were bound to maintain it so as to bear the heavy motor traffic of to-day. As the Lord Chancellor said, the question raised is of unusual importance. On the one side it involves an undoubted limitation of the rights of user of public roads carried by a bridge over the lines of a railway company, and on the other it may throw on railway companies the obligation of reconstructing such bridges to meet the growing demands of heavy modern traffic. The circumstances in which this case has arisen must exist in many instances, and they are likely to increase.

The case was originally heard by Mr. Justice Warrington, who decided against the railway company, but his decision was unanimously reversed by the Court of Appeal, who held that the company were not bound to maintain a bridge stronger than that originally constructed. The House of Lords now upheld the decision of the Court of Appeal, Lord Haldane, however, dissenting. The Lord Chancellor said he could not think that the words of the section imposing on the company the obligation to maintain the bridge could be construed as meaning that such bridge was to be a changing and varying structure, altered from time to time to meet the growth of traffic wholly unforeseen and unexpected when the railway was made. The bridge was only bound to carry the road through which it passed, and that was the road determined at the moment when the railway was built, for it did not follow at all that the road within the meaning of the section was the same thing as the use of the road, which might change from time to time. It was the bridge constructed in conformity with the provisions of the Act which the railway company were bound to maintain, and they were, in his opinion, subject to no further or added liability. Lord Haldane, on the other hand, thought that the principle developed by the earlier cases was that where persons acting under statutory powers conferred on them for their own convenience interrupted a highway, they would, unless the statute provided otherwise, be presumed to be under an obligation to construct such works as would restore to the public the use of the highway and to maintain the works at their own expense in a condition adequate to the public need. When in such circumstances the public road which had been interrupted was restored by being carried on a bridge, the bridge and the road, which thus formed part of it, must be kept up to such a standard as would admit of the public enjoyment of the facilities for ordinary traffic over the road that they would have had if the interruption had not taken place, and if the substituted works had not been executed. Having regard to the importance of the question involved, it is perhaps unfortunate that there has hitherto been this doubt as to the law. It has now been settled by the supreme tribunal, and we can only say that we are glad that Lord Haldane's judgment is on the record.

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Cleansing Economies.

It was a happy thought on the part of those responsible for the arrangement of the recent Cardiff meeting of the Institute of Cleansing Superintendents to include in the programme a paper by the convener of the Glasgow Cleansing Committee. The fact that members of local authorities are thus prepared to take part in meetings of technical societies organised by officials is significant; and in our view it augurs well for the future development of municipal work in this country. It may be said at once that Bailie Robert Mitchell thoroughly justified the invitation that had been extended to him by reading a paper which was full of practical interest. It would appear that Glasgow is indeed fortunate in having the services as Convener of the Cleansing Committee of one who is really interested in its work, and has taken the trouble to make himself acquainted at first hand with the most modern methods of grappling with the complex problems which arise in connection with the removal of the waste products of a great city. The paper itself covered a wide field, and we must here confine ourselves to a brief reference to one or two of the most important matters dealt with.

In the first place reference was made to the question of self-propelled traction, which was the main subject for discussion at the meeting, and to which we referred in these columns last week. Bailie Mitchell then spoke briefly of several matters in regard to which what we may call scientific economy can be effected. For example, it has been found at Bradford that the emptying of street gullies by means of petrol suction pumps is not only more sanitary than the old-fashioned

method of ladling, but is actually more economical. With regard to the separate collection of waste paper, too, it was pointed out that an actual and immediate profit may be made by its sale during the war, because of the high price that is obtainable in the present abnormal circumstances. Further, even in normal times a considerable indirect saving can be effected by keeping all paper out of bins, and thus increasing the weight per cubic yard of the remainder of the refuse, with a consequent economy in haulage. Bailie Mitchell also referred to the importance of standardisation. This is a principle which is applicable to almost any kind of organisation, and, speaking broadly, the more it is applied the greater will be the efficiency and economy gained. How can it be applied in the organisation of a cleansing department? First, standard nomenclature would enormously facilitate the collection of statistics from various towns and their accurate comparison. Again, the standardisation of plant and appliances would mean greater speed and economy in replacing worn or broken parts, and a minimum dislocation of work in case of breakdown. It is unnecessary to give further examples here, but the whole question is certainly one which might with advantage be taken up by the institute in consultation with the manufacturers. Finally, a word may be added as to the appeals that are from time to time made to householders to burn their own combustible refuse. It is often said that such appeals have but little or no result. May not the reason be that they are too intermittent? Experience in advertising shows that a spasmodic effort in the issuing of circulars is doomed to failure. To be successful the appeal must be sustained.

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A New Advocate of Housing Reform.

Sir Leo Chiozza Money, M.P., whose versatility and industry are continuously at high water mark, has been discussing the housing question in the *British Weekly*, and he leaves us in no doubt that if only he had the handling of the problem it would be very soon settled. He thinks that to rehouse all the people of the United Kingdom would be "child's play" as compared with what we have done in this war for the purposes of war. "We do not build houses," he proceeds, "because we follow the conception that somehow or other enterprising persons will arise and put up good houses. We cling to this belief, although we know that a thousand vested interests prevent the demolition of existing bad houses, just as they prevent the destruction of good new ones." It must be admitted that the vested interest in unwholesome property is powerful and widespread—it is not confined to one or two, but belongs to many classes of society—but it seems to us indisputable that the main reason why housing reform lags behind is the confirmed apathy with respect to the subject of the house-dwellers themselves.

Sir Leo Money has received from an American correspondent some particulars of the standardisation of building construction in America, from which he gathers that by standardising parts one can form in concrete 1,000, or 10,000, or 100,000 window-frames, or staircases, or chimneys. "The staircases," he writes, "which in the average house are so indifferently made of poor material that creaky stairs are almost universal, could be turned out in concrete as easily as shelling peas. Suppose you decide to make 100,000 or 500,000 small dwellings. You can have them of one type or ten types, and you can have one or ten different types of such details as the staircase. The making of the standard parts, in material so good that it will last indefinitely, offers no difficulties to the practical man, if he is given a chance to do the job. The one million people normally employed in the building trade of the United Kingdom, working on such lines, could deal with houses at the rate of hundreds of thousands a year. And even by ordinary methods of construction they would do magnificently if properly directed to national ends." The thing seems quite simple in theory, but to attempt to carry it out in practice, even "after Armageddon," would be quite another matter. Sir Leo Money is manifestly on the right track, if he is a trifle airy and over-confident, and it is satisfactory to find that even his enthusiasm for standardisation does not exclude the view that houses should be beautiful as well as healthy.

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Surveyors and Petrol.

In view of the absolute necessity at the present time for directing all our national resources towards the successful prosecution of the war, there has been little or no criticism of the recent decision of the Government to take a census of petrol requirements with a view to the organisation of the available supplies of that commodity in the national interest. The census has now been taken, and the licences that are now being issued show that the quantities applied for are in almost every case being drastically curtailed. No complaint will be made of this, for it must be assumed that it is necessary in the public interest. Letters are already being written to the Press, however, pointing out anomalies in regard to the percentage allowed of the amount requisitioned for different purposes. For example, we observed in a recent issue of the *Daily Mail* a letter signed by "Road Surveyor" in which he bluntly asked whether it is possible to explain on what system the licences are being issued? We refer to his case as it must be typical of many others. His machine is used almost entirely for public work, and his district is of such a size that a car is a necessity if proper supervision is to be exercised. His application, based on average consumption, was for twelve to fifteen gallons a month, and his licence is for six gallons for three months! He adds in his letter that a friend who uses his machine for occasional visits to the golf course applied for two gallons a month, and has got all he asked for. The question of the issue of petrol licences to municipal engineers is one which might well be taken up as a matter of urgency by the institutions representing those officials.

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Rates and Reserve Funds.

The new standards of thought set up by the war have been responsible for a revision of many ideas which were accepted without question two years ago, but which may now be regarded as "old fashioned." For example, it used to be thought a fundamental of rating practice that the rate for any year must be limited to such an amount as was necessary for meeting the expenses of that year. Now, however, most local authorities are effecting substantial economies in various directions, and they are living in anticipation of a suddenly increased expenditure on the termination of hostilities. To meet this situation some authorities are collecting a rate of the old amount, and are placing any sum saved as a result of economies to a reserve fund, which is usually being lent to the Government for the time being. The latest example is afforded by a report to the Poplar Borough Council by the Works Committee which states that by reason of the postponement of paving works and reduction in the estimates for repairs to streets considerable expenditure on street works will be necessary after the war, and expresses the opinion that steps should now be taken by the formation of a reserve fund to provide for such expenditure. They have accordingly referred to the Finance Committee a proposal that £1,000 per quarter should be raised by rate to form a reserve fund to provide for special expenditure on street works after the war. As we have pointed out before, we are a little doubtful both of the justice of this long procedure to present ratepayers and also of its legality.

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The Destruction of a Macadam Road.*

By T. W. ARNALL, assoc.m.inst.c.e., City Engineer and Surveyor's Office, Birmingham.

Many studies are available to members of the institution of the way in which a macadam road is made, may be made, or should be made: the way in which such a road is destroyed may be a useful addition.

It will be assumed that the road is made up of fragments of broken stone, of various sizes, compacted together, into a more or less solid mass having as small a proportion of voids as possible, and perhaps bound or slightly cemented together by dust or mud. It will be convenient to give but small consideration to positive cementing materials such as Glutrin, Rocmac, and others more or less soluble in water; and to others not soluble in water, such as tar, Plascom, bitumen, and the like. It will be further convenient to assume that the foundation is quite hard and unyielding; if it be not so, the agencies which are destroying the macadam must be supposed to extend into the foundation, which thus becomes part of the structure to be destroyed.

It must first be emphasised that it is impossible to make a solid mass with rounded stones of any size. If round marbles of any size, but all of one size, are thrown loosely into a box, there may be 40 per cent or more of empty space, and no amount of shaking or arrangement can possibly reduce the voids to less than 26 per cent of the total. This proportion is quite independent of the size of the marbles; if they are 1-in. diameter they cannot fill more than 74 per cent of the total space, and they cannot fill more than 74 per cent of that space if they are too small to be separately visible. This supposes that they are all of one size, but obviously if the box be first filled with big marbles, other smaller ones can be placed in the cavities, and there is room for still smaller ones in the cavities then left. The voids can thus be reduced without limit by introducing smaller and still smaller balls into the cavities. It is, however, essential that the sizes be properly graded; it is of no use trying to fill the interstices with balls of only one size, however small they may be; the spaces must first be filled with balls of as big a size as possible, and the smaller ones kept back until no larger ones will go in. (See Figs. 1 and 2.)

For round balls substitute rounded stones of any size or shape, and the argument is substantially true; with oval or potato shaped pieces the voids may be reduced below what would be given by round balls, but the voids cannot be altogether abolished, however small the rounded pieces may be, and however carefully they may be graded and packed.

This argument breaks down when applied to flat-sided stones, free from rounded edges and corners, and it would follow that the road should be made up of such flat-sized, sharp-edged pieces; but even then they must still be graded into suitable sizes. A sett pavement in which the equal-sized pieces are separately placed by hand is not under consideration; a macadam road is made up of random sizes and random shapes, mixed in some way and compacted together as solidly as possible by rolling. Many of the edges and corners are rubbed off in the process, and many of the stones are broken; it is truly a rough and unmechanical process, but it has to serve since no better one is known.

THE BEARING CONE.

The effect produced by a load placed upon a stone forming part of the surface of such a mass may be readily traced. If the stone is resting upon one other only, it must sink or roll over until it bears also upon two or three others; each of these in turn must rest upon at least three others, so that in the result the pressure of the load is passed downwards to the foundation in the shape of a cone, with a rather broad base at the bottom. The cone cannot be closely defined, principally because there is not enough known about the shape and arrangement of the stones composing it. Their size has not much to do with it. If they are all smooth and round like marbles or bicycle balls they are easily pushed aside, and the base of the cone must be a very broad one. If they are flat and parallel, say like pieces of slate laid flat, there will be no side-long pressure, and the base may be no larger than the last piece resting on the foundation. If the pieces are still flat and parallel, but *not* laid flat, the cone will appear in some form or another, and result in a broadened base. In general it will perhaps not be far out to assume that the slant side of the cone is at an angle of 45 degrees; its base will then have a diameter equal to twice the thickness of the macadam. If this is 6 in. the pressure of an isolated load on the top will be spread over a circle about 1 ft. in diameter, and it may therefore be concluded that a steady load concentrated on a small area on the top produces but a moderate pressure per square inch at the bottom.

The way in which the cone would be modified when the load takes the shape of a wheel is indicated in Figs. 3 and 4. A 3-in. tyre will give a cone about 15 in. wide at the bottom, or five times the width of the tyre; an 18-in. tyre will give a cone about 2 ft. 6 in. wide, or something less than 1¾ times the tyre width. The proportionate width of the cone is much less in this latter case than the other, and it must obviously be less in proportion the greater the width of the tyre.

SIZE OF WHEELS.

From Figs. 5, 6, 7 and 8 it is evident that the size of the wheel will have an important influence on this question. If the road were perfectly hard the wheel would touch it in a thin line only, and its diameter would be immaterial, but some sensible depression must be produced on a macadam surface; the line of contact becomes widened out into a sensible area, and with any given degree of sinking, the larger the wheel the larger this area of contact becomes. To fix ideas, Fig. 7 shows that if the sinking is 1 in., the length of contact will be about 9¾ in. with a wheel 2 ft. in diameter and 1 ft. 4½ in. with a wheel 5 ft. in diameter, as in Fig. 8. In other words, the maximum pressure under a 2-ft. wheel will fade away to nothing at a distance of about 5 in. from the centre, and at a distance of about 8 in. in the case of the larger wheel. Hence it is certain that for a given load the sinking of a large wheel must be less than that of a smaller one, for the same pressure is spread over a greater surface, and its average intensity must be reduced in proportion. The mischief done to the road must also be reduced in something like the same proportion; hence the reason for the loadings of the wheels of heavy motor cars as fixed by the Board of Trade Rules, which are summarised in Fig. 10. Roughly speaking, the permitted loads per inch of width of the tyre are proportional to the square root of the diameter of the wheels; they are not exact probably, because the practical dimensions of inches and hundredweights would lead to awkward fractions if more precisely worked out. As the length of contact varies in the same proportion with different wheels, the nett result is that the different loads and wheels give the same average load per square inch upon the surface.

The cone is not shown in Figs. 5 and 6 because there is no definite spot on the surface to start it from; whatever the depression caused by the load may be, it dies away gradually to nothing at the point where the wheel leaves the ground. Still the cone is there, nevertheless. In Figs. 3 and 4 its sides are bounded by a definite crack starting at the surface, passing somewhere between the stones big and little, and tapering away in thickness as it nears the bottom. In Figs. 5 and 6 the crack is replaced by an indefinite looseness among the stones, perhaps aggregating in amount to the definite crack met with in the other case. The only way to prevent the formation of these cracks is for some of the material to escape sideways out of the cone and close up the crack as fast as it is formed. But in the absence of cavities into which this material can escape, this amounts only to pushing the crack into another place, or probably making many little cracks instead of one big one. That there is such a sideways tendency to escape is well seen in a pulpy road; the rut formed by a heavy loaded wheel is plainly due to a lifting at the sides as well as to a sinking under the wheel. Often it may

* Paper presented at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

be seen in front of a roller at work on a thick coating—the mass rises as a flat wave in front, to be forced down again as the roller moves over it. In any case there is no elevation, whether the view of one big crack is taken or a multitude of small ones; whichever view is taken the destruction of the material goes on just the same.

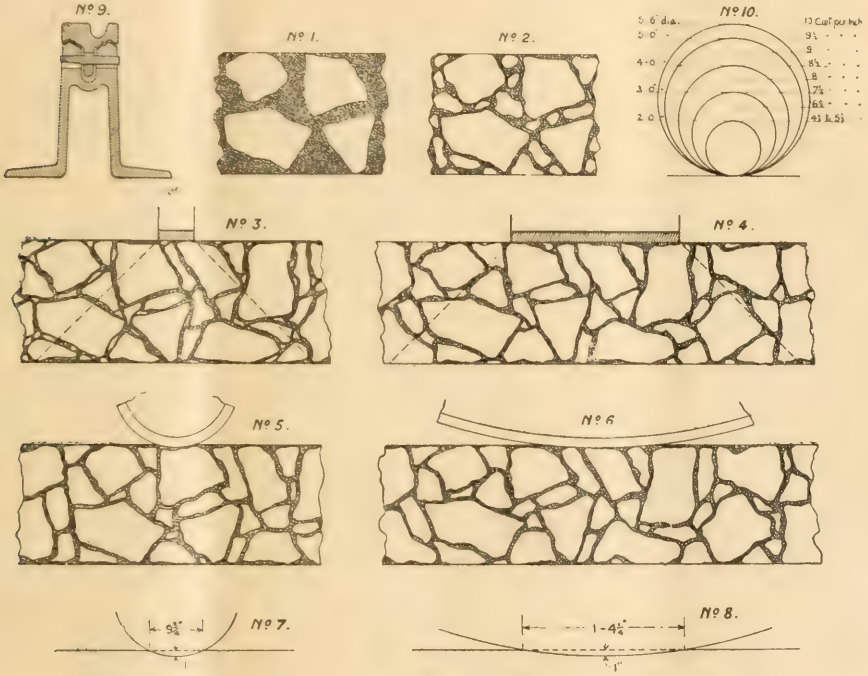
WEAR IS INTERSTITIAL.

It therefore appears that a load cannot be applied at any place on the macadam surface without producing a cone of some sort below it in which the macadam is further compressed; also, if the load is sufficient to cause any sinking whatever of the surface, a crack will be formed between the cone and the unloaded parts of the mass. As the load moves this crack and all the commotion below move along with it, and the whole mass, from the top to very near the bottom, is set in motion in its turn. In this movement the stones, big and little, are forced into new positions. Not one of them moves until it is pushed, and if it is not forced into a cavity already formed, it is forced against something else which opposes the movement. If this obstacle does not yield the pressure may be great enough to break it. It is easier to displace or to crush a small stone than a large one, and the smaller it is the more easily it is dealt with. The nett result of the movement under the passing load is that the whole mass is being ground up into smaller fragments; the larger pieces get their corners and edges broken off, and the angular, flat-sided pieces of the original mass become like rounded pebbles. The moving load makes these bigger pieces act like the pebbles in a cement-grinding mill; the smaller pieces are broken down to sand, and the sand is ground down to mud, or to dust, according to circumstances.

BARKER'S TRAM RAIL.

There is a principle at work here which is worth a closer study, and it is perhaps best brought out by considering what happened to some tramway rails laid down in Birmingham in 1882. They may appear to have little to do with a macadam road, but the experience gained by them was so clear and definite that it will be a useful help in dealing with the present subject. A section of the rail is shown in Fig. 9. It was a steel rail in pieces 10 yds. long, supported on and fastened to closely spaced cast-iron sleepers 2 ft. 11 in. long by steel keys, two to each sleeper. The sleepers were solidly bedded in concrete in the usual way, and the cavity inside them was also solidly filled with concrete. Attention must be fixed upon the successive pairs of bearing surfaces—first the bottom of the rail and the top of the sleeper; next the bottom of the hole in the rail and the bottom of the key; next the top of the key and the top of the hole in the sleeper; lastly, the bottom of the sleeper and the top of the concrete. The theory of the arrangement was that when the rail was worn out it could be easily removed, a new rail keyed to the sleepers in its place, and the whole structure would then be as good as new.

These expectations were not realised. The only wear expected was that on the top surface, and it was found to be the least important of all. Much greater was the wear on the bottom of the rail and the top of the sleeper, and the sleeper wore more than the rail. There was further wear between the key and the rail, and between the key and the hole in the sleeper. Then the surface of the con-



FIGS. 1—10.

crete suffered. Leaving the bottom of the sleeper out of account, it will be seen that there was wear going on at seven different surfaces that had not been provided for, and long before the rail was "worn out" in the ordinary way the wear on these other seven surfaces gave serious trouble. It will be seen that they were all one behind the other, somewhat like the links in a chain. An electrician would say that they were arranged in series, and the same current of destruction had to pass through them all. There was not much to measure at any one surface, but the aggregate was sufficiently imposing.

The stability of such a structure depends upon the stability of every part of it. Consider the first three mentioned pairs of surfaces. If wear takes place at one of them, that pair is loosened, and, as an inevitable consequence, the other two pairs of surfaces become loose also. As in a chain pulled tightly, if one pair of links becomes loose every other pair of links necessarily becomes loose also. It cannot be that all are tight except one; they must either be all tight or all loose. In this case looseness of any one of the pairs of surfaces below the street level meant that grit was constantly getting in between them; every passing car crushed this grit, wearing away the surfaces, and making room for fresh grit to enter as soon as they were

parted again. The frequent presence of water ensured the ground-up stuff being washed away and fresh abrasive material being brought into its place. The looseness of the rail caused the sleepers to become loose, water filtering into the bottom was violently surged to and fro as the car passed over the top. There could not have been much water to begin with, but there was always enough to completely fill the space below, and its scouring effect could have been no greater if it had been 10 ft. deep.

There are four points to be emphasised in this experience, as follows:—

(1) The wear on the top surface was the least important of all.

(2) If one of the other pairs of surfaces became loose, all the others became loose likewise, and opportunities were set up for fresh wear taking place at every one of the surfaces.

(3) The smaller bearing surfaces suffered most. The bearing surface of the keys was only about a quarter of a square inch at the most, but each was as important to the stability of the whole as one of the larger surfaces.

(4) The presence of water greatly increased the mischief. It was under pressure and in motion. It was always bringing fresh grit into position, and washing away that which had been ground up into mud, and was no longer capable of withstanding any pressure or of packing any vacant spaces.

Every one of these points is immediately applicable to what is going on in the destruction of a macadam road.

(1) The wear on the surface is the least important of all.

(2) If a crack forms and makes some parts loose, all others behind them in the direction of pressure necessarily become loose also.

(3) The small pieces suffer most. The large pieces can carry no pressure unless the small ones support them, and a pressure which is sufficient to break any one of them may at the same time break scores of others behind it. The blow must be carried on from one piece to another.

(4) Water greatly increases the mischief. It cannot be kept out of such a porous mass. It is put in motion by every passing load, swilling away the smaller particles which might act as packings, and so taking away the support of the larger ones, which have to withstand the shocks. It acts as a lubricant and makes movements easy that would otherwise be impossible.

DAMPNESS *v.* WETNESS.

The mention of water perhaps makes it convenient to point out that its mischievous effects appear to arise when it is in excess. Wetness must not be confused with dampness. Dampness holds fine particles together; it tends to prevent their movement, and so may have a beneficial effect on the road. Damp sand tipped out of a cart will often hold together in lumps. It has no distinct "angle of repose." The sides of the lumps will stand vertical, and even overhang, so that there must be a real tension between the particles. Nothing of this sort is possible with either dry or wet materials. If they are perfectly dry, the "angle of repose" may be about 45 deg. If they are perfectly wet, it may be very little, and if there is any movement in the water it may vanish altogether; the sand may settle down to a dead level at the bottom of the water. It is obvious that this has important consequences on the stability of macadam, for cracks and cavities filled with water cannot be violently closed up under the traffic without that water being forced out, carrying the finer parts of the mass into new positions. If the mass is merely damp, these cracks and cavities are not full of water.

CLAY.

In addition to water the effects of clay have to be considered in many, if not in most, places. It is not mud, although it may be a constituent of the mud. A little mud mixed with water may settle, and leave the water perfectly clear; a little clay mixed up in the same way may take days, or even weeks, to settle, and whatever does quickly settle is pretty sure to be sand and not clay. It is a decomposition product of felspar, and is therefore a constituent of most of the road-making stones used in the country. The change in the felspar does not often affect the strength or value of the stone, and yet so much of it as has actually been changed into clay is readily washed off the surface of a freshly broken stone. Break the stone again and fresh clay may be washed off the newly-broken surface. In certain stones this may go on without limit; the finer the rock is broken or ground up the greater is the area exposed, and the greater is the supply of clay that can be washed out of it. This process is probably a frequent cause of the supply of clay, which is seldom absent from street mud; the clay makes it of a greasy, slimy nature, and tends to cause it to bake into hard cakes as it dries. Down below the clay acts as a lubricant, as a kind of wet grease, helping in every action tending to make the stones slide upon or rub against each other. It goes wherever the water goes, and makes movement easy under loads that would be quite incapable of shifting a dry, gritty mass.

POTHOLES.

A fairly general sign of the destruction going on is the formation of potholes. For some reason or another a soft place exists in the macadam, perhaps because of a segregation of the smaller, and therefore the weaker, stones; perhaps because the rolling has been less thorough there than elsewhere, as against a manhole, or against the granite edge of a tramway where the paving has caught up the roller before the macadam was properly consolidated. The surface at such places is quickly worn or beaten down into a definite hole which holds the water. When all around is dry, this place is kept in a pulpy condition. If any water is visible in the hole it is certain that all below is thoroughly soaked and in the worst possible condition to carry the traffic. The bottom of the hole usually shows comparatively large angular stones; the smaller ones and the mud and grit are all washed away; probably much of this has been done by the upward rush of water from below, squeezed out of the cavities near to but not under the hole. On the surface the rolling settles most of the larger stones so as to show a flat side upwards; in a pothole the stones are not in this position. Most of them show sharp angular points upwards, which are easily broken off by iron-shod wheels, or easily shaken by the grip of rubber tyres. In either case the conditions lead to a greater wear and tear at the bottom of the hole than on the adjacent surface.

A hollow place in the road is a kind of mechanical equivalent to a flat place on a tramcar wheel, and it is well known that a very small flat has a most surprising effect. A flat an inch wide on a 31-in. wheel makes a bump that can be heard 500 yds. away, and yet when this flat meets the rail the axle drops less than the 100th part of an inch. So likewise, when a wheel meets with a depression in the road, the hammer-like blow given to the bottom of the hole seems out of all proportion to the minute drop in the axle which caused it. It is so because the drop is not the free drop of a falling body under the action of gravity; the downward acceleration is due to the energy of the whole load stored in the deflected springs and suddenly released on the small mass of the wheel; the downward acceleration for a small space may be thirty or forty times that due to gravity alone. There is here quite sufficient reason for the destructive effects on this already weakened and sodden macadam.

But there is generally a still further mechanical effect. If the speed is great enough the upward push given to the wheel on the forward side of the hole takes place so quickly that the wheel is thrown upwards to a greater height than that from which it fell, to fall again and meet the normal surface at some point further on. The bump has become a jolt. At this second place there is a blow nearly as severe as that received at the bottom of the hole, and thus a second hole is quickly formed in advance of the first one. This, again, gives rise in its turn to a third hole, and so in a short time one pothole becomes the cause of many others being formed. They are spaced at pretty regular intervals, and there is no doubt that the intervals would be quite regular if the conditions giving rise to them were regular likewise.

RUBBER TYRES.

The peculiar destructive effect upon the surface produced by rubber tyres has not yet been referred to. The rubber may be easily shortened in one direction if left free to expand in another. Referring to Fig. 5, it is evident that there is no load upon that part of the tyre which first comes in contact with the ground. As the wheel moves on this part becomes loaded, the load increasing to a maximum when the part in question is under the axle, dying away again to nothing as it leaves the ground

at the back of the wheel. As soon as the load comes on the rubber is compressed in the direction of pressure, and must expand sideways to precisely the same degree. But the traction on rubber is enormous; as soon as it comes in contact with a stone on the surface, that stone is firmly gripped and must move along with the rubber which is expanding in one direction because it is being compressed in another direction. Thus the stones in front are pushed forwards, at the sides they are pushed outwards, until the axle comes over any one of them. Then the movement is reversed; the stones in the centre are gradually pulled back, and those at the side pulled inwards into something like their old position as the rubber recovers itself on escaping from under the load. The importance of this process arises from the fact that no stone displaced is ever pulled back into its own place. Not one of them can be violently pushed forwards or sideways without at the same time disturbing multitudes of smaller ones which are not in contact with the rubber at all, and are therefore free to take up new positions. This prevents the stones ever reaching their old positions as they are pulled back again. The passing tyre leaves most of them lying loose on a disintegrated surface. It is commonly said that the loose stones are "sucked" out of the ground; it would be better to say that they are "shaken" out. Every one of them has been pushed in one direction and the next instant pulled back again, but in the meantime the bed on which it laid has been broken up, and it now lies loosely upon instead of being bedded in the surface.

MOTOR 'BUSES.

Motor 'buses call for special mention, since the destruction wrought by them is greater than their weight or number would account for, even when full allowance is made for the heavy loads and high speeds. Beyond these things are the facts that the 'buses are similar in structure, and at any given part of their route they tend to travel at the same speed. At any given hole the same jolt is experienced every time; the wheel comes down on the same place as the one before it did, and whatever mischief is caused by one is exactly repeated by every other one that travels along the same track. Any variation in the load, size of wheels, or speed would tend to prevent accumulation of effects, but as this would interfere with standardisation of structure and regularity of working, it appears that the results must be accepted as inevitable. All the advantages of uniformity and standardisation belong to the owners of the vehicle; the defects and consequent mischief are passed on to the owners of the road. An arrangement of this sort should be capable of some more equitable adjustment.

INTERSTITIAL WEAR.

It is certain then that the destruction of a macadam road is not a question of wear on the surface. A wheel may pass by and leave no track behind, but many of the small stones below have been crushed in carrying the load. The smaller these pieces are the less chance they have of escaping destruction when the pressure comes upon them. In some way the total wear will depend upon the total area of the pieces forming the mass rather than upon their weight and number, and when these pieces are small the total area of surface they expose runs up in a quite unexpected manner. A cube of 1 in. side exposes a total area of 6 sq. in. Cut up this cube into little ones of one hundredth of an inch side—*i.e.*, into pieces the size of fine sand—there will be just the same weight of material, and it will fit just the same bulk of solid space, but the total area of surface will now be 600 sq. in. instead of 6 in. If cut up into particles small enough to be classed as fine dust, or mud, the total area exposed by, say, an ounce of material becomes something enormous. Movement under pressure means wear and tear over a large proportion of this great area. For every grain that is crushed there will be many that suffer by having some edges or corners ground away. The idea that this fine stuff is useful for packing and bedding the larger stones may lead to a fallacy. A certain stone may be so bedded on and supported by, say, 1,000 or 10,000 very small ones. When the blow comes upon it, that blow has to be passed on to and in some way shared among the thousands of very small ones. The "sharing," however, can only be among those that are arranged (as an electrician would say) in parallel; those that are arranged in "series," or one behind the other, have the same blow passed through the lot. There is no "sharing" in this direction. In a water-bound mass no tension is possible, and one bit cannot help another one alongside it; it can only receive the shock in front and pass it on to the bits behind. It may be so broken in the process that when the shock comes next time it will have to be received and passed on by some other neighbouring bit that had hitherto escaped. Water ensures that this fine stuff is kept on the move, and any really effective packing or support of some particular stone can only be of service for very few repetitions of the blow.

REMEDIES.

Apparently, what is required to check this destruction is something in the nature of a cement; something which can withstand a positive tension capable of keeping the parts together when any forces tend to separate them. Two well-marked classes of such cements are in use. Of those soluble in water there is the fear that they may dissolve again and be washed out of the mass. Efforts have been made to prevent this by chemical action amongst the constituents of the cement so that the resulting compound is no longer soluble. Of the cements not soluble in water we have the natural bitumens and very many tar products and mixtures. True bitumens are expensive, and their use only becomes practicable by extensive admixture with cheaper materials. All tar products and mixtures suffer from the defect that the various constituents which give them fluidity and are essential to their cementing properly are all somewhat volatile, so that the cement changes with time. This evaporation, however, can be largely controlled, and the valuable properties of the compound preserved for a long time by periodical attention to the surface. All these matters, however, belong to a study of construction, and cannot therefore be properly included in the present paper.

NEWCASTLE-ON-TYNE TRAMWAYS.

CITY ENGINEER ON THE NEED FOR RENEWALS.

The city engineer of Newcastle-on-Tyne, Mr. W. J. Steele, reporting on the condition of the tramway system, states that the length of tramway opened for service, measured as single track, is 66½ miles. The maintenance of the permanent way has been £9,545 0s. 9d., equivalent to £143 per mile of single track, or 0·40d. per car mile; in addition to ordinary maintenance, £1,580 18s. 1d. was expended in renewals —equivalent to £24 per mile of single track, or 0·06d. per car mile—so that the total cost of the permanent way (exclusive of capital charges) was £11,125 18s. 10d. —equivalent to £167 6s. 1d. per mile of single track, or 0·46d. per car mile.

A considerable length of the permanent way is in urgent need of renewal, but the great difficulty in obtaining a sufficient supply of labour has prevented that necessary work being undertaken. The major portion of the track has been in use for nearly 15 years; consequently the fact that the present heavy service on a permanent way having many steep gradients is maintained at such a comparatively small cost is satisfactory; but it is inevitable that the cost will be greatly increased as soon as opportunity will permit of renewals being carried out.

Shrinkage of Reinforced Concrete.—Mr. F. R. McMillan, of the University of Minnesota, has been making a number of tests to determine the shrinkage and time effects in reinforced concrete. According to a summary of his paper, an American exchange states, the following results were obtained: Beams tested were 5½ in. deep, 30 in. wide, and 12 ft. long between supports. Concrete consisted of 100 lb. cement, 2 cub. ft. sand, 4 cub. ft. stone, hand mixed. Results show that shrinkage of ⅜ in. to 1 in. in 100 ft. can be predicted when concrete is exposed to the ordinary dry air of a heated building. Changes in moisture content will retard shrinkage, and even cause swelling. The yielding of concrete under compressive stress with time is greater as the unit stress is greater, and goes on indefinitely. The deformation was found to be three to five times that produced immediately upon application of load. The time yielding under stress combined with shortening due to shrinkage may result in deformations fifteen to twenty times those expected from calculations.

NATIONAL PHYSICAL LABORATORY.

ROAD RESEARCH WORK SUSPENDED.

The report of the Executive Committee for the year ended March 31st last states that the work of the National Physical Laboratory has been greatly affected by circumstances arising out of the war. A considerable part of the ordinary research work has been in abeyance; in its place a large number of special investigations have been undertaken for Government Departments and the testing work for Government Departments has also very greatly increased. There has been a reduction in other test work, and the laboratory has thus been almost entirely employed with Government work.

The committee record with regret the deaths of two of the earliest and most prominent supporters of the laboratory. Sir Andrew Noble was one of the first advocates of the establishment of a National Physical Laboratory, and was a member of Lord Rayleigh's Committee, the report of which led to its foundation. From the beginning he was among its greatest benefactors; his generosity provided much of the equipment with which it started; his warm support helped it through early difficulties, and his enthusiasm for their work was of the greatest value to the director and the staff.

Sir Arthur Rucker was also a member of Lord Rayleigh's Committee, and it was later his duty, as secretary of the Royal Society, to conduct, with H.M. Treasury, the negotiations that resulted in the foundation of the laboratory, and to draft the scheme of organisation under which it has been worked. The success which has attended it is due in no small measure to the skill with which the foundations were laid. From that time, throughout his active life, he did not cease to take a deep interest in its welfare, and to further its progress whenever opportunity offered.

Owing to the great increase in the work during the past twelve months, it has been necessary temporarily to augment the staff of the laboratory considerably. The additions made have been mainly of men disqualified for service, or women. At the present time the number of women employed at the laboratory in various capacities is forty-seven. "Their work," the report states, "has been very efficiently done, and the laboratory is much indebted to them for their assistance." The thanks of the committee are also tendered to a number of voluntary assistants who have given their services to the laboratory. In some cases the release of men on service has been obtained for work at the laboratory.

The work in practically all departments of the laboratory has been very heavy throughout the year, and the committee express their indebtedness to the staff for the readiness with which the additional burdens imposed on them by the circumstances prevailing have been undertaken. The committee are satisfied that in many ways the work done has been of great value and importance to the nation.

THE ROAD BOARD LABORATORY.

In the Road Board Laboratory mechanical tests on forty-nine varieties of stone for road construction were made during the year. Of these stones, forty were tested for resistance to attrition, thirty for resistance to repeated impact, eighteen for resistance to abrasion, seven for cementation, and nine for crushing strength.

A series of tests on seven kinds of granite setts was made for the engineer to the board. The tests were made in duplicate, and included resistance to abrasion, impact and crushing.

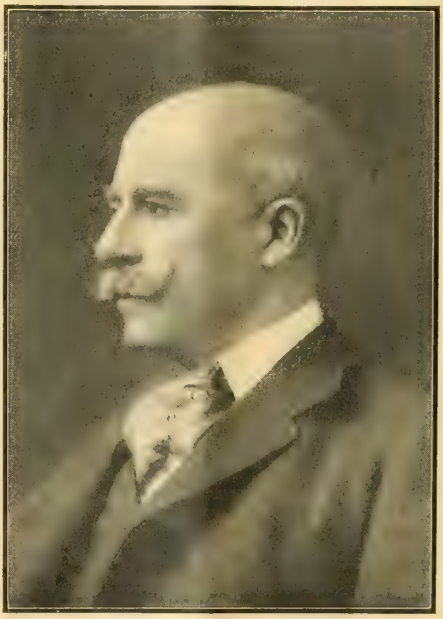
The series of tests on asphalt carpets laid on a concrete foundation, which was started last year, was continued; but, owing to the suspension of some of the activities of the Road Board and the difficulty of obtaining suitable labour, the tests were stopped early in the year. Other investigations which have been undertaken have given valuable indications of the causes of failure of bituminous sand carpets, which have been under test in the road-testing machine.

Proposed New Water Area for Sydney.—The supply of water for Sydney is running short, and the Cataract reservoir is now only one-third full. The Water Board has urged the Minister of Works to proceed immediately with the construction of a new dam at Cordeaux at an estimated cost of £490,000.

DEATH OF MR. JOHN HUTCHINSON.

The world of road making has lost a keen critic and enthusiastic student by the sudden death, from pneumonia, on Sunday last, of Mr. John Hutchinson.

Born in Ireland some sixty-nine years ago, Mr. Hutchinson had travelled extensively, and had gathered a vast store of reminiscences, coupled with a very extensive knowledge of modern paving materials. Until the tar trials in 1907 his interest was chiefly confined to asphalt and bitumens, on which subject he was well versed and well known. During the later years of his life he applied himself most earnestly to the problem of modern road making, and was a frequent contributor to the technical Press. He was a very strong advocate of the principle that every surveyor or road engineer should be in a position to test and prove the quality of the materials he was purchasing. With that end in view he invented a series of special instruments, standardised thermometers, &c., which have proved themselves of the greatest value to students of the science of road making. He quite recently published a treatise on "The Testing of Tars and Pitches for Roads" as a practical guide for engineers and surveyors. Mr. Hutchinson's Stand at the International Road Congress Exhibition held in London in 1913 attracted universal interest, since which time he had continued working and improving incessantly.



The Late Mr. John Hutchinson.
[*Photo by G. C. Beresford, Yeomans-row, S.W.*]

AN APPRECIATION.

"One Who Knew Him" writes: As a man he was gifted with a peculiarly attractive presence which made him a welcome companion at any time; he could illustrate his points in a discussion with a variety of experiences, and his retentive memory enabled him to quote instances and authorities in a remarkably correct manner. As a friend he was staunch and true, and once his confidence was won could be relied upon for support in many an argument or difficult position. He was a well-known figure in Westminster, where his loss will be heavily felt; his stories and experiences, told with true Irish wit, have often relieved the tedium of a meeting by their brilliance and aptitude. It may truly be said of him that he has left his mark on the problem of modern road making, and that his loss will be long felt by a large circle of friends and acquaintances.

Motor Vehicles for Municipal Work.

DISCUSSIONS AT CLEANSING SUPERINTENDENTS' CONFERENCE.

In reporting in our issue of last week the opening proceedings in connection with the nineteenth annual conference of the Institute of Cleansing Superintendents, at Cardiff, we reproduced a number of papers in which members of that body dealt with the question of the use of motor vehicles for the removal of house refuse and for street cleansing and watering. Interesting discussions followed the presentation of the papers. Consideration was first given to a contribution by Mr. J. Terry, cleansing superintendent, Nottingham, on results obtained by electric vehicles in the removal of house refuse, and to one in which the president, Mr. W. Harpur, city engineer of Cardiff, gave an account of the operation of steam tractors in cleansing work.

Mr. W. H. ECCLES (Stockport) said Mr. Harpur's paper proved what he had already pointed out, that motor vehicles for refuse collection were of no use. The continuous stopping and starting must be a great strain on the mechanism of any vehicle. He was impressed in walking round Cardiff to find that one half of the work was done for the officials, in this sense, that the boxes, bins, barrels or things were put on the side of the kerbstone, which must mean a great saving of time and expense in the course of the year. He wished he could get his own folk to do it. (The President: Try them.) Another point in the paper which impressed him was that the vehicles were unsuitable for going on to tips. Still, there was no doubt about it that the time was coming when they would have to consider the adoption of mechanical vehicles to help them to do their work. What with the price of horses and provender, and the cost of labour, it was becoming a very serious matter. The paper read by the president had been most instructive, and they would be able to go back to their councils and committees with a capital report of the experiences of Cardiff.

Mr. JAMES JACKSON (Birmingham; hon. secretary of the institute) said he was afraid he could not speak in some respects so definitely as Mr. Terry on

ELECTRIC VEHICLES.

He was out to learn, and had followed the development of electrical vehicles for some years. He went to Paris some four years ago to see the Fram electric vehicle working. He was very much struck then with the electric vehicle, and the confidence in it of the Paris municipal committee. They tried the Fram machine, made by the De Dion Company, and they were so struck with it that they ordered 100 straight away. Since that time he had carefully followed the work of the electric vehicle. He did not think they had had sufficient time to study the data which had been accumulated. He desired to say as straight as he could that of all the electric vehicles on the market at the present moment, he liked the Edison pattern better than any other. That was as great a compliment as he could pay to the Edison electric vehicle. His difficulty was that the Edison vehicle cost something like £1,000 to £1,100. He did not think a member of any corporation would like such a high cost vehicle, and he hoped that the Edison people would bring it down to a more reasonable sum. The Edison vehicle had been more used in this country on their work than any other vehicle, and the data which had been accumulated was the most reliable they had to work on at the present moment. At the same time he was bound to say that the Ironclad Exide battery was not giving them one minute of trouble in Birmingham. The Birmingham Corporation, when they decided to purchase two of the Orwell type of vehicle, did not purchase because it was the best machine on the market, but with the object of demonstrating the Exide battery. There were plenty of people ready to purchase the Edison vehicle, but the main object in view was to show that there was more than one apple on the tree. He could make certain criticism on the Orwell vehicle, but he did not feel disposed to do so. The main advantage of the Orwell vehicle was that the battery was quite good. It was guaranteed for two years, and at the end of two years the makers were prepared to replace it. He believed, and so did their electric light manager, that their battery was going to have a longer life than two years. If they got anything like 2½ years, the extra half-year would be

ALL PROFIT

on the vehicle they were putting down at the present time. Proceeding, Mr. Jackson said that a great many of them were convinced the electric vehicle had come to stay. They wanted to tabulate their information as fully as they could so that all their colleagues should have the benefit of their experience. He liked the closing words of Mr. Harpur's paper—that care should be taken in selecting a vehicle. What might be suitable in one town would not be suitable in another. Some towns had steeper gradients than others; some towns had back lanes and others had not. In some cities they had to bring portable tins 30 or 40 yds. into the street, which all meant great delay to an expensive machine waiting at the door. They must go slowly in the matter, accumulate their data, spread it amongst the members, and gradually come to a sound conclusion as to what they had to say about the electric vehicle.

Councillor DIGGLE (Rochdale) said that Mr. Terry had stated that the average mileage of the machine was 20 miles per day, but if they worked out the figures in his paper, the machine was only travelling 14 miles per day. With regard to wages, £151 14s. 9d., that could only be 28s. a week for two men. Was that the only cost of working this machine? Were there only two men with it? Were there any further men helping to load this machine?

Alderman J. P. BROWN (Blackpool) said that both the cleansing superintendent and himself were interested in this work, and they wanted some method of collecting the refuse quicker and at less cost than at the present time. He was disappointed with Mr. Terry's paper on those grounds. He thought in the first place the machine was

TOO EXPENSIVE TO GO FROM DOOR TO DOOR

for the collection of house refuse. He did not know of anything yet to beat the horse to do the work. He thought that horses should collect the refuse and that it should be handed over at certain points to motors to take it to the destructors. It was too expensive to have these machines going from door to door. They only travelled about 15 miles a day, owing to the fact, he supposed, that so much time was taken up in loading.

Mr. J. A. PRIESTLEY (Sheffield) said that Mr. Terry's facts, figures and information were very similar to his own, and their experience was on similar lines. It would perhaps be interesting to the members and delegates to know that since the preparation of figures quoted by Mr. Terry in his paper he had issued a further report. The report, presented to his committee in March last, dealt with twenty-two weeks' working of their No. 1 vehicle, and with six weeks' working of their No. 2. He had now got figures which included forty weeks' working of No. 1, twenty-four weeks' of No. 2, and eight weeks' of their No. 3, and the conclusion he came to on the shorter period had been amply borne out by the lengthened trial they had now had. Mr. Priestley quoted figures with reference to the use of the electric vehicle in the collection of street sweeping. He said he lent their city surveyor the No. 3 vehicle, and the result of a week's working night and day showed that on street sweeping the cost of the work was slightly over £2 less than the cost when the work was done by the horse vehicle. Mr. Priestley referred to the remark of Alderman Brown, that the heavy capital cost of the vehicle prohibited its use in house-to-house collection, and pointed out that in both Sheffield and Nottingham that was exactly the work on which the machine had been engaged, and if it could show a

SAVING ON HORSE LABOUR

under those conditions after taking full account of capital charges against the vehicle, it disposed of the suggestion that the high capital cost was a barrier to the success of the machine. Referring to Mr. Jackson's remarks on the Edison as against the Orwell machine, Mr. Priestley said that he was not out to advocate any particular kind of machine. The reason why they in Sheffield selected the Edison battery vehicle

as being the most satisfactory was simply on account of the guarantees they were able to get from the makers. Personally, he would prefer to use a British-built vehicle, with a British battery, but they had to consider what they were buying, and if they could have on the one hand a guaranteed battery of eight years' well, until some other people could come along with a guarantee equal to that, he was going in for the vehicle and the battery he could depend upon. He was taking no risks.

Alderman Lloyd (Bristol) said that they had about 200 horses at work, and they had come to the conclusion that they would have to employ motors. The question to be decided was: What was the best type? and he was there to find that out. The papers clearly condemned

THE STEAM TRACTOR;

petrol was condemned, and the electric motor held the field. He thought, however, they were all agreed that the electric motor had not yet reached its final and perfect condition. They must be prepared to believe that there would be great improvements in the electric batteries running the motors. There was a great future before electric traction in this country, and it rested with the gentlemen present to consider carefully the best form of motor and the best construction of motor. He was in favour of obtaining an electric wagon for ash collection, but he thought there must be a change in construction to make the work of loading very much easier. They ought to impress on the makers the necessity of some more suitable construction.

Councillor Jones (Wolverhampton) said he was one of those old-fashioned people who believed that the horse was still the best thing to employ for refuse collection. For many years they collected their refuse at Wolverhampton with horses and carts, but of late years they had adopted a light wagon system of collecting, which gave them practically the same results as if they employed an electric vehicle. Their drivers collected three wagon-loads per day, and they got six tons, which was equal to an average of two tons each per day. The only advantage he could yet see with the motor vehicle was quicker transit backwards and forwards to the depot. They had had an electric vehicle on trial for a few days at Wolverhampton, but it was not the success they wished. With an electric vehicle, the driver did nothing to assist in the loading, which was not the case with wagons and horses.

Mr. William Greig (Glasgow) asked Mr. Terry to what extent he overloaded his vehicles. He also asked what was the mileage one might reasonably expect from a charge. Had Mr. Terry resorted to boosting in order to exceed that mileage. Mr. Greig said that at Glasgow they had some electric vehicles on order, and they would be put on long journeys when delivered.

Bailie Coughtrie (Motherwell) said that he was anxious to find out the best method of collecting refuse in a comparatively small town. What might be suitable in a large city would be a failure in a smaller place.

Alderman Dr. Greenhalgh (Bury) said that their experience, with a population of 60,000, was that the

COST OF COLLECTION

by motor was 3s. 5d. per ton, and by horse 3s. 10d. per ton. That justified them in going forward with any plan that made for progress. No doubt most committees would jib at the cost of electric vehicles, but he believed it would be possible in the future to produce these vehicles at a less cost than £1,000. If that were so, it behoved cleansing departments of municipalities to keep their eyes open and see what could be done. He would like to know what interest Mr. Terry allowed on the electric motors.

Mr. Terry, replying to various points raised in the discussion, said they allowed no interest on their vehicles, but they allowed 10 per cent depreciation on the working parts. He added that their vehicles had been purchased out of revenue. He hinted in his paper that the electric vehicle was not standardised. When they got to a standardised vehicle, and had a demand for these vehicles, the cost would go down enormously. Whatever applied to large cities applied to smaller towns, provided sufficient horses were now at work to justify the introduction of a motor vehicle. If there were only two or three horses at work it would not pay to introduce an electric vehicle, because there would be insufficient work for it to do; but if they had six or eight horses they would be justified in purchasing an electric vehicle. With regard to the method of discharging from vehicles, with a three-ton vehicle, by simply touching a switch it tipped itself in 20 seconds. Replying to Mr. Greig, Mr. Terry said they had no boosting. They charged the battery to work to three hours and had no boosting above the normal rate. The mileage per charge was 30 to 40 with a full load, and 50 with a half load. With regard to over-loading, there were representatives of vehicle makers present, and in their presence he did not propose to tell what loads he had put on his machines. In his paper he had shown that they had removed 422 loads by a vehicle of 3 tons' capacity, and the average loads were 3·05 per ton. They could judge for themselves what those loads might have been. Mr. Jones, Wolverhampton, had said that horses were not yet done with. The only practical point of view was that of £ s. d., and, while they could not compare the cost of the removal of refuse in one town against another, the only method was at how much per ton could they deliver the refuse at their depots by motor or by horse, and the figures quoted that morning had amply shown that the cost per ton was less by motor than by horse. Therefore, if they could get the

COMPARATIVE COST

in their own towns, it did not matter whether their vehicles cost £1,000 or £2,000, provided they allowed for depreciation. Mr. Jones had made one entirely wrong statement—that they had, with an electric machine, one man sitting on the box. With their vehicles in Nottingham the man who was driving assisted with three men in loading, so that there were, practically, no wages paid to the driver beyond a little overtime on Sundays. Complaint had been made of the construction of the electric vehicle. If it was meant that the vehicle was somewhat higher than some of the wagons they had in the streets to-day, he agreed, but the height of the vehicle now in use was not greater than the height of the old carts now in use in some places. Alderman Brown had said that the cost of the vehicle was too great to go from door to door. That was exactly the work in which their vehicles had been employed at Nottingham, and they were able to show a saving of 8d. per ton in favour of the electric vehicle, irrespective of the initial cost of £1,000. Councillor Diggle had raised the question of mileage. Their present average mileage was about 13 per day. He stated in his paper that 20 miles was the average, but he was working their two vehicles at present in districts nearest to their depots. The vehicles now on order would work in districts some three or four miles away from the depot, and that would give an average of 20 miles a day. With regard to the £151 for wages, that covered a period of 26 weeks. They started their men at 26s. 6d. a week, and that went on for six weeks, and then for another six weeks they had an increase, and they were now paying 32s. per man. If they took the variation between the two that gave the £151.

(To be concluded.)

Cost of Highway Maintenance in Newcastle-on-Tyne.—Mr. W. J. Steele, the city engineer, in his report for the year ended March 31st last, states that the approximate total length of highway now maintained in Newcastle-on-Tyne is 254 miles, and that the cost of maintenance per mile, exclusive of debt charges, and after reducing the total mileage to a figure which makes the back streets equal in width to the front streets, is about £91.

Pembrokeshire Roads: Maintenance Costs.—In his annual report, presented at the last meeting of the Pembrokeshire County Council, the county surveyor, Mr. Arthur Thomas, stated that since last year an additional 6 miles of road had been taken over for maintenance, which brought the total mileage to 144, and the total cost, after deducting a refund from the Great Western Railway Company for the upkeep of their overhead bridges, had been £8,407, or an average of £58 7s. 8d. per mile, against £56 4s. 2d. in the previous year, being an increase of £2 3s. 6d. per mile, which was more than accounted for by the rise in material and the increase in the roadmen's wages. The cost of the rolling, including the cost of the hired rollers, was £640 1s. 5d. Steam rolling had ceased for the present.

The Surveyor
And Municipal and County Engineer.

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THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Should we not all of us be greatly obliged to Mr. F. W. Arnall, of Birmingham, for the lucid and scientific paper on "The Destruction of a Macadam Road," which he read at the annual meeting at Blackpool? Did he not very clearly describe the action of the forces that are at work, under traffic conditions, to disturb and break up a road, and should not these deductions be very helpful to anyone engaged in the construction of roads?

* * * *

Do not the Dutch set us an example of engineering perseverance and courage, when we read that they at once set to work to pump out the sea water from the 50,000 acres of valuable land which were inundated in January of this year, and that they have already succeeded in this gigantic task? When we are told that no less than 20,000,000,000 gallons of water had thus been dealt with by pumping in about four months, are we not struck with the engineering skill which has made such a feat possible?

* * * *

Is it not rather interesting to see by the statistics of traffic taken on the London-Holyhead road between Montford Bridge and Nesscliffe in April of last year that the total average traffic per day was only 324·5 tons, of which about 60 per cent was motor traffic of various descriptions, and does it not tend to show that we are apt to exaggerate the amount of traffic on a road until we can ascertain by correct observation what are the facts? Could it not be assumed that, with the statistics already prepared, the average amount of traffic on our secondary rural roads cannot be much more than 150 tons per day? Shall we not have to alter our views considerably as to what constitutes heavy, medium, and light traffic?

* * * *

Would it not be well if there could be some official pronouncement as to whether crude or refined tar is the best for painting the surfaces of carriageways? Is it possible that, as a matter of fact, there is not much difference, and that the discussions and differences of opinion which arise in connection with this question are due to the variations in quality of both refined and crude tar? Would it not be better to adopt the Road Board specification and thus secure uniformity?

* * * *

Are these not halcyon times for boys, owing to the shortage of labour? But was it not wise of the Truro Rural Council not to accept a recent recommendation of a Parochial Committee to appoint a boy of fourteen years of age as "temporary assistant engineer" at St. Agnes Waterworks, especially as the engineer in charge of these works wrote that he could not be held responsible for the boy if he were left in charge of the machinery? Can anyone blame him for his caution?

* * * *

Are there any limits to which reinforced concrete can be introduced in construction? Is it not interesting to note, for instance, in *Ferro-Concrete* for this month, that there are now on the market reinforced concrete road signs which are made of white Portland cement and crushed granite, the letters being moulded in a plastic state and dovetailed into the groundwork, making the whole a monolithic structure, with the letters painted so as to contrast effectively with the white background? Should not this be a cheap, efficient and almost everlasting description of sign post? But where can they be procured and what is their cost?

THE ACTIVATED SLUDGE PROCESS.

RESULTS AT WORCESTER.

The question of sewage disposal has occupied the attention of the Worcester City Council for a considerable period, and it must be with a sense of satisfaction that they are at length able to feel that the system which they have recently adopted has proved to be a success. It will be remembered that the city council gave permission to Messrs. Jones & Attwood, of Stourbridge, to experiment at the sewerage works in Bromwich-lane with the activated sludge purification process. The firm have been quietly carrying on the necessary works for several months, with exceptionally successful results. When Messrs. Jones & Attwood made an offer to the corporation, and expressed their willingness to accept payment on results, Mr. T. Caink, the city engineer, at once saw the possibilities of the system, and, acting on his advice, the city council decided to give it a trial. Hence, Worcester is the only place in England where the most modern system of sewage disposal on a large scale can be seen at work.

The experiments are at present confined to one of the two sets of tanks at the works, and with these they are dealing with about one-half of the city's sewage. Slight alteration to the tanks has been required, but with the exception of putting in the air-pipes to provide the supply of air, and the provision of an air compressor driven by an electric motor, very little extra expense has been incurred in this direction.

Mr. Caink is highly satisfied with the new system, and is of opinion that the ultimate saving to the ratepayers will be certainly not less than £1,000 a year. The system has only been running for three months, and it has to run for twelve months before Messrs. Jones & Attwood are entitled to payment. Under the previous system the sewage was pumped up from the tanks into filter beds, of which there are no fewer than six. When the new method is in full operation, and the other set of tanks adapted for their purpose, these filter-beds and the irrigation land will be scrapped, thus setting free a considerable area of land for other purposes.

The arrangement between the corporation and Messrs. Jones & Attwood was that the effluent should not contain more than 4 parts per 100,000 of suspended matter, and that it should not be capable of putrefaction, and the analysis, amongst other things, has special reference to these two conditions. A sample of the effluent is forwarded to the county analyst every week. At present five samples have been analysed. The worst of these analyses shows that the conditions laid down are being met, this sample containing 3·8 parts of suspended matter, while the next highest sample contained 1·2 parts, and in none of the samples was there the slightest evidence of putrefaction. Further, the quantity of sewage required to be treated under the agreement was 750,000 gallons a day, and the quantity actually being treated is 800,000 gallons.

Saving in Street Lighting at Hull.—At a meeting of the Hull Corporation Works Committee on Wednesday, it was reported that the manager of the British Gas Light Company had attended a meeting of the sub-committee with reference to the company's account of £5,331 for street lighting for the half-year ended June 30, 1916, and agreed to make a deduction of £1,550.

DUMFRIES COUNTY BUILDINGS.

REINFORCED-CONCRETE CONSTRUCTION.

Of the many municipal buildings in which the Indented Bar and Concrete Engineering Company, Westminster, have been responsible for the reinforced concrete work, the new County Buildings at Dumfries are of outstanding interest, as not only is the whole work of the most fire-resisting nature, but several portions are fine examples of the manner in which the reinforced concrete members may be harmonised with the architectural design. This latter is particularly noticeable in the roof of the council chamber, the details of which are given in the latter part of this article.

Dumfries County Buildings—Elevation.

The main block is 164 ft. long by an average 30 ft. wide, with two wings each 65 ft. by 29 ft., enclosing a courtyard approximately 85 ft. by 65 ft., approached by drives on either side.

Our reproduction of the front elevation of the building, which is constructed of stone from the Locharbriggs Quarry, shows the handsome and dignified appearance of the structure.

On the ground floor accommodation is provided for the education department, road surveyor, county clerks, collectors, committee rooms and Chief Constable. On the first floor are the members' writing room, committee rooms, chairman's room, sanitary and veterinary inspectors' offices, chemical and bacteriological laboratories, and medical officer's department. The second floor is used for general purposes, such as stores, &c. The council chamber is situated in the right-hand corner of the back of the main block, and the height of two floors.

The reinforced concrete work (states the *Indented Bar Bulletin*) consists of the whole of the floors and roof, which latter is asphalted. The first floor is generally 4 in. thick, supported on beams of various sections according to requirements. In the cases of the larger rooms on the ground floor the panels of the ceilings are formed by the beams supporting the first floor. In one particular instance, however, the first-floor slab is increased in thickness to 8 in., eliminating the beams and giving a perfectly flat soffit.

The second floor is similar to the first floor, but the beams supporting the floor slab also form the bottom ties of the roof trusses. These mansard roof trusses vary in span from 25 ft. 6 in. to 38 ft., and carry the roof slabs, which are 3½ in. thick, and a 3-in. reinforced concrete ceiling, approximately 4 ft. below the roof proper. Thus the whole of the second floor, roof trusses, roof slabs and beams, including the dormer cheeks, are monolithic, resulting in an economical structure of great strength.

The roof of the council chamber, which is approximately 50 ft. long by 30 ft. wide, is of the barrel-vaulted type, and consists of a main segmental arched side of each of the three bays formed by these ribs spanning 26 ft. 6 in. clear, with a rise of 10 ft. 3 in. from the springings to the underside of the crown. These ribs are all 2 ft. deep, the two end ones 2 ft. 2½ in. wide, and the two intermediate ones 2 ft. 8 in. wide, supported at either side by columns 13 ft. high from the floor level to the tops of the caps. On either side of each of the three bays formed by these ribs secondary vaultings have been formed of 4-in. slabs, curved to a semicircle of approximately 13 ft. radius, springing from the column caps. The ribs, in order not to interfere with the architect's designs, project for 7 in. only below the roof slab, the remainder of their depth being above the roof level. A flat slab 4 in. thick and 8 ft. wide has been formed on either side of the roof, over the secondary vaultings. Ventilation is provided by means of a duct 24 in. by 12 in., in section extending from the centre of the roof to the centres of the two end bays.

The architect was Mr. J. M. Dick Peddie, of Edinburgh, and the contractors for the reinforced concrete work, Messrs. J. Marshall & Company, of Hawick.

The reinforcement throughout consisted of indented bars.

LIVERPOOL WATER SUPPLY.

THE NEED FOR ANOTHER PIPE LINE.

In his report upon the operation of the Liverpool water undertaking during 1915, Mr. Joseph Parry, the consulting water engineer to the corporation, makes the following observations:—

"The continued increase in the consumption of water brings us appreciably nearer to the complete exhaustion of existing resources. The figures given above show an average consumption per day for last year of 40,003,000 gallons, but if allowance is made for temporary decreases caused by the war, this would have been appreciably exceeded. This average quantity does not by any means represent the extent of the demands which the committee have to meet. The highest consumption in any one week of last year was 304,377,000 gallons, being equal to 43,482,000 gallons per day, and over a period of four weeks there was an average consumption per day of 42,200,000 gallons. To supply these demands the existing pipe lines of the corporation will only deliver, including the well supplies, a maximum quantity of 46,000,000 gallons in any one day. From this some millions should be deducted for repairs and other contingencies. Any demand in one day, or succession of days, exceeding the delivery capacity of the pipe lines can only be met by drawing upon the stocks held in reserve in the Prescot reservoirs. These reservoirs are very small in proportion to the demands. When full they hold little more than four days' supply to the district, and when drawn upon in consequence of a high summer use, or of a fracture on the pipe lines, cannot easily be replaced. The above figures leave no room for doubt as to the extreme urgency of the demand for more water. Fortunately the city is spared the anxiety and difficulty of discovering a source from which to obtain a new supply. The water is already at Lake Vyrnwy; a right of way from Vyrnwy to Liverpool exists. All that remains to be done is to lay pipes through which the water may be conveyed from its source to those who need it."

Mr. Parry states that the demand for water along the aqueducts also continued to grow, the total supplies given to local authorities and others outside of the Liverpool compulsory areas having now risen to an average per day of 4,569,000.

Institution of Municipal and County Engineers.

ANNUAL GENERAL MEETING AT BLACKPOOL.—(5.)

Following the speeches reported in our issue of last week, the discussion, at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool, on Mr. W. H. Schofield's paper on

IMPROVEMENTS OF HIGHWAYS TO MEET MODERN CONDITIONS OF TRAFFIC,

was continued by Mr. A. J. PRICE (Lytham), who said he wished to ask Mr. Schofield if the tarred slag was wearing better than the tarred granite. Mr. Schofield happened to live in his district, and he knew practically the work they had done. He thought Mr. Schofield would admit that in the work he had done with tarred granite he had hardly had a failure, and he could not see why other people should not do so. However, they could not use poor granite and get the same result. If they put it on a road with a bad foundation, or under trees, they would get different results altogether. Therefore, they had to use their judgment as to where they used tarred granite. In the majority of cases success or failure was due to the consistency of the tar. Being in a small place, he was able to keep an eye on what was done. He very rarely got failures. But on a road where it was damp they could not get good results. He quite agreed with what Mr. Finch had said as to wishing that the members of their councils attended the institution meetings. He had just been roasted on the amount of money he had spent on his secondary roads—£1 2s 6d this year—towards which Mr. Schofield had allowed him £200. They were supposed to be allowed one-third of the cost. The poor surveyor was looked upon as a very expensive man when he spent money which was necessary on the roads. He was very glad to get these figures, as they would be very useful to him.

Mr. T. S. PICTON (Eccles) said the borough of Eccles was one of the sufferers in connection with the amount of heavy traffic upon the road which Mr. Whyatt had mentioned. About a mile of that road—the Liverpool and Manchester main road—passed through Eccles. In 1893 that length of road was paved with ordinary macadam. They entered into negotiations with the county council and the Government, and they borrowed a sum of £12,000 to reconstruct a portion of the main road. They took up the granite macadam, and in some lengths they put down granite setts and in other lengths flag rock setts. These sections were completed in 1901-2. Those granite setts, which were not put on a concrete foundation, would bear close examination. The majority of the setts were placed on an ordinary cinder foundation. After seven or eight years the flag rock setts began to wear, to crack and to break up. Naturally, the Eccles Council had a conference with Mr. Schofield, and a year and nine months ago they took up a section of flag rock setts, which were actually pulverised and no use at all, and they placed granite setts on a 6-in. concrete foundation. He took the precaution, after the concrete was thoroughly set, to place a 2-in. sand cushion upon it, to lay the flags upon, so that the damage which was happening was not due to the steel-tyred vehicles coming into contact with two hard substances, because there was that 2 in. of cushion. There were three kinds of setts used, some from Norway, some from Scotland and some from Shropshire. If they went over that area, which was laid eighteen months ago, and carefully examined the setts which were obtained from Scotland and from Shropshire, they would find about twelve crushed setts in a square yard. What was the experience with the granite setts laid in 1901-2. They would find scarcely three or four damaged setts in a square yard. Now that was the position on that main Manchester and Liverpool road—on which the traffic had increased so enormously in the last seven years. It proved to him that the proper thing was to bar steel-tyred vehicles and go in for rubber tyred. And the most important thing was to get the quality and the value of the granite material. Then again, about the speed limit. They read about ships passing in the night; well, it was these wild creatures who passed in the night who did a great deal of damage to their roads. He had had £3 or £4 worth of concrete flags smashed owing to a heavy motor vehicle being driven on to a footpath during the night.

Councillor EILEY (Birmingham) said he was of opinion that the discussion of this question of road construction had been too general and not sufficiently in detail. First, they wanted a general classification of roads. It appeared to him that there were quite as many remedies required for roads as there were roads. Although they could not classify every road by itself, they could treat roads according to different classes. He would like to go to a conference which would discuss roads on motor-'bus routes on which setts were broken up, roads in factory districts, roads in slum areas, and ordinary residential roads. All these roads had to receive special consideration. He suggested that they should have papers on definite kinds of streets, and have criticism on those papers. It would be very beneficial to authorities.

Alderman MUIRHEAD (Liverpool) said, as regarded heavy traffic, there was no form of road paving like setts, if the setts were of good quality. They had a street leading out of the Central Station at Liverpool on which the setts had been down for thirty-one years, and they would last ten or fifteen years yet. Whatever those setts originally cost they would be very cheap. He did not think the motor goods traffic on the roads should be taxed. The goods which were principally carried were food and clothing, and how were they going to cheapen prices if they put on taxes for the use of the roads?

Mr. LATHAM (Burscough) contended that motor users should comply with the regulations which were issued, and which fixed the maximum weight on the axle of any motor vehicle at 8 tons. He had a curious experience with a Roemac road where one half of the road wore away while on the opposite side, with a tarred surface, the Roemac was as good as ever. On the one side they had a canal bridge with a heavy gradient, and yet no damage was done. As to Roemac, he could confirm what Mr. Platt had said. They tried to scarify a length after it had been laid only twelve or fifteen months, and the men asked him if he wanted to break the scarifier. They could not get into it with the scarifier tines or picks. The farmers in his district complained bitterly of the tarred surfaces in summer, and he had been told that the man who invented tar-macadam ought to be hanged. A tar-painted surface was good in summer, but bad in winter. With regard to Mr. Matthew Jones's statement as to his concrete road, he might say that his Roemac road was as good to-day as when it was laid down. His council were so strong on the question of tar-macadam that with horse-drawn vehicles they considered it took two horses to draw a load of 2 tons, formerly drawn by a single horse. With regard to tarred granite macadam, Mr. Price said that it was a complete success. He had roads which had been laid down with tarred granite macadam six years as good as when laid down, but he laid some down on the main road with disastrous results. If they got their tar too soft it was spreading in summer, and if they got it too stiff, it was brittle. Granite tar-macadam was an absolute failure with heavy motor vehicles.

Mr. SCHOFIELD, in reply, said he must thank Mr. Gettings and the other gentlemen who had so kindly expressed their appreciation of this paper, which he wished he could have given in greater detail. He said in opening that if he began to give results of his experiments with all the different kinds of materials, he should be repeating what had been so often said and taking up their time needlessly. With regard to Mr. Gettings, he thought the first question he asked him was in which way did he disagree with the Road Board weights, as given in their classification form. He largely disagreed with the horse-drawn weights as given for Lancashire, not so much with the mechanically-propelled vehicles. The heavy vehicle, one horse, was given as a weight of 1·25 tons. In Lancashire, the tare weight was very nearly that without any load at all, and if the average weight had been given as three tons instead of 1·25 tons, it would have been more nearly correct. With regard to heavy vehicles, two horse, the weight was given as 2·5 tons. They had had loads regularly of 6 tons weight drawn by two horses. Then, further, with traction engines

and trailer the weight was fixed at 8 tons. Most of their traction engine traffic in Lancashire was conveying large boilers or heavy castings, and the greater bulk of their traction engine traffic was carried on a bogie 10 tons in weight, and carried very often a steam boiler 36 tons in weight. He thought the motor lorries, rubber tyred, were given as 6 tons. That was a very moderate weight. Mr. Gettings also asked for particulars of the different roads on which they had laid tar macadam. He laid tar macadam on the Preston, Bolton and Chorley road four years ago, and this had required no repairs except two tar paintings. It was laid 5 in. thick, the traffic was 1,982 tons daily, and the width of the carriageway 32 ft. Most of the traffic was heavy commercial motor wagons. The Blackpool-Preston road length of tar-macadam, laid 5 in. thick, required annual tar-spraying. The traffic was 600 tons per day. And 340 tons was mechanically propelled. The great disparity between the summer and winter traffic on this road made it impossible to give an average. The difference between the summer and winter traffic was that there was between three and four times as much in the summer as in the winter. During the four months of the summer season in Blackpool they had twenty-five or thirty motor chars-à-bancs a day, as well as the increase in the ordinary motor traffic. In another case a road 26 ft. wide carried 1,040 tons. On that road tarred slag lasted for a period of seven years, after which he had to retop the whole length. Mr. Gettings asked what experience they had had in retopping tar-macadam surfaces. So far he had been fortunate. With the one exception he had just mentioned and one other on a trunk road, he had had no need to retop any tar-macadam road in the county. His experience so far as tar-macadam was concerned was only for a period of seven years. Short lengths were laid perhaps ten years ago, but these were not of sufficient importance for him to give any particulars of them. Then Mr. Gettings asked as to motor 'buses. In Lancashire, probably owing to the populous areas being so well served by the tramway system, there had been no expansion of motor 'buses. His roads were not suffering from that form of traffic. They were suffering, as all waterbound roads were in the last few years, in that they required repaving with some other surface. It was impossible to maintain roads with waterbound surfaces under motor 'bus traffic. The first length of Durax paving was put down ten years ago, as an experiment on moderately trafficked roads. It was not put down in competition with tar-macadam at all, but as an experiment purely; the idea being that if a rough-dressed material like Durax could be obtained at a suitable price it would be a suitable method of dealing with the moderately trafficked roads—roads which they felt they could hardly afford to pave with dressed granite setts on a concrete foundation. Mr. Platt, of Rochdale, agreed with the use of granite setts, but complained of the smashing of the setts by the modern form of traffic. There were very few surveyors in this country who had had a longer and wider experience of granite setts than Mr. Platt had. He thought the paving in Rochdale spoke for itself. Mr. Platt had examples, and good examples, too, of all kinds; and he was bound to admit—though he argued if traffic was increased beyond a certain point it would still be economical to put down granite sett paving—that the steel-tyred vehicle was considerably shortening the life of granite paving. There were lengths of granite paving which had been down for fifty years. There was granite paving which he had put down twenty-five years ago, and was still in good condition; but the last two or three years' effect of steel-tyred vehicles had been very disastrous to it. Still with all that he was of opinion that the most economical pavement for heavy traffic roads was a granite or a wood pavement. With regard to Roemac, he had not used it very extensively. The only use they had made of it was on gradients which would not permit of being tar-sprayed. The result during the last two or three years had been decidedly satisfactory. He thought the treatment of gradients with Roemac was very well worthy of experiment. Mr. Platt agreed with him as to the width of roads. He was certainly strongly of opinion that many of their roads were too narrow for present-day traffic, especially their rural roads; but he did agree with Mr. Chapman that one could point to many places where corners had been rounded and roads had been widened where the new conditions were certainly much more dangerous than they were before. He travelled the previous night from his office to Blackpool behind a motor char-à-banc, and his speedometer showed 23 miles an hour. The driver of the char-à-banc could not possibly have done it before the improvements had taken place. It did not add to the safety or the longevity of the road when such speeds were run on it. He quite expected Mr. Hadfield would not agree with his suggestion that granite-sett paving was the most economical. He had had the pleasure of hearing his views on that point previously; but he was still unconvinced. Mr. Finch asked him why the granite tar-macadam was not as satisfactory as the slag tar-macadam. The whole of his work had been done with materials previously tarred. His experience was that granite tarred-macadam would go into potholes in the middle of the road. He did not say that it was a failure in all cases. Mr. Price, of Lytham, was naturally very proud of his tarred granite roads. They were very excellent roads, and had been down some years. He lived in Lytham, and thoroughly appreciated them, but if Mr. Price was to put his tarred granite roads where there was heavy motor traffic they would not stand very long, and he would not be so satisfied with tarred granite-macadam. With regard to the Durax paving which Mr. Stilgoe mentioned, the Durax paving they had laid, and they had laid several miles of it, was put down on the old macadam foundation; it was not put down in any case on a concrete foundation, and generally speaking it had been very successful indeed. There were lengths outside Liverpool which had been down ten years, had had no repair, and were still in good condition. He had no experience whatever of Durax paving on a concrete foundation. Then, with regard to Alderman Muirhead and the taxing of motor wagons. He quite agreed. It would be perfectly ridiculous for a commercial county like Lancashire to enter into any harassing policy against motor wagons. At the same time, he could not get away from the fact that these were doing immense damage to their roads, and contributing nothing towards the upkeep of them, and he did think a reasonable contribution could be exacted from them without interfering with their usefulness or development in any way. In his opinion the use of rubber tyres ought to be made compulsory.

(To be continued.)

County Councils and New Omnibus Routes.—At a meeting of the County Councils Association, on Wednesday, the Highways Committee, having considered the question of framing a general policy for county councils in regard to new omnibus routes, recommended that maps be prepared, showing new routes of traffic and roads capable of carrying 'bus traffic, and that as far as possible the councils should get the owners of omnibuses to co-operate by friendly arrangements as to the routes to be used. These recommendations were agreed to.

St. Paul's Bridge.—In the House of Commons, on the 20th inst., the Minister of Munitions was asked whether he had requested the authorities who had in hand the purchase of property necessary to form the approaches to the proposed St. Paul's Bridge, to suspend such action during the war, as had been the course imposed upon other local authorities having in hand constructional and other schemes involving expenditure of money. Dr. Addison, who replied, said the Ministry took no action in regard to requesting the suspension of the purchase of property, but only in regard to the construction or demolition of buildings. He was unable to trace any communication with the authorities in question.

Edinburgh Municipal Economies.—It was reported at the Edinburgh Town Council recently that cleansing expenditure had been reduced by nearly £7,000. On the fire brigade estimates there had been a saving of £400, public parks and gardens £1,200, baths £700, public libraries £1,100, wash-houses £500, and streets and buildings £12,000. The decrease in revenue from private lighting was £10,000, and from public lighting £1,500. Against these decreases there was an increase in the revenue from motor power of £1,750, making the nett decrease in revenue £9,750. On the expenditure side there was an increase of £2,000 for coal. Over all the results for the year they were left with a credit balance of £42,000.

Organisation in Cleansing Work.

By BAILIE ROBERT MITCHELL, Convener of the Glasgow Cleansing Committee.

A paper dealing with the various branches of a cleansing superintendent's work was presented at the recent annual conference of the Institute of Cleansing Superintendents, by Bailie Robert Mitchell, convener of the Glasgow Cleansing Committee.

After expressing pleasure that the members of the Institute were so alive to up-to-date with regard to the subject of mechanical traction, the author of the paper turned to the question of the cleaning of street gullies. The old and insanitary system of doing this work by means of ladles, instead of by the new method of petrol suction pumps, would not, he considered, be tolerated after the war.

In connection with the matter of the shortage of labour, he thought it would be interesting to know how the question of women labour had been dealt with in various cities and towns, both as regarded hours and wages. Referring to the disposal of old tins, Bailie Mitchell remarked that, while many towns were not obtaining even "scrap" prices for these, others were getting three or four times as much. "How many towns represented here to-day," he proceeded, have introduced a system of waste-paper collection?" This could be made to pay directly during the war, because of the big price to be obtained, and indirectly after the war, because by keeping all paper out of bins, the weight per cubic yard of the refuse which had to be brought to the destructors was increased, thus effecting a substantial saving on the haulage. There was also, of course, the revenue derived from the sale of the paper. A valuable product from destructors was fish manure; yet a number of towns were still burning it. When war broke out this class of manure was at a discount, and higher prices had since been obtained than ever before, proving successfully that there was a home market which only needed cultivating. Another source of revenue was the clinker from destructors. Dealing with the necessity for standardisation in connection with the cleansing superintendent's work, Bailie Mitchell showed how matters could be simplified by a common basis being fixed with regard to the preparation of tabular returns, and types and sizes of bins, plant and appliances and mortar-making. Another matter that had come under his notice was the difficulty of arranging convenient times for the removal of refuse in terrace, cottage and villa houses. With the adoption of the portable bin system new difficulties had arisen, more particularly in England, owing to the system of housing. Men commenced, as in former years, at, say, 6.30 a.m., and had a difficulty in getting their first load owing to householders not having opened their gates. With the ashpit system this was not a serious matter, as only one or two required opening. Now, however, it was necessary to open scores before breakfast. What was being done by various authorities to meet the difficulty? He knew of one city which had a great difficulty in this respect, the work having to be arranged so that the men could fetch any load near the destructor so as to get back by breakfast, whereas, if breakfast were taken first, the men could commence at a later hour in the morning, finding householders out of bed, gates open, and able to proceed with their work. The work could then be organised in the most economical way of collection.

In proposing a vote of thanks to Bailie Mitchell, Mr. R. WILLIAMSON (Manchester), in touching upon a number of the points referred to in the paper, said that the destructor question appeared to have been shelved lately. Many people were going back to the old idea that tipping, although objectionable, was the best way of getting rid of town refuse. If they took the refuse to a tip, they had no clinker to dispose of.

Alderman ELIOTT (Newcastle) seconded. At Newcastle they had engaged women at 6d. an hour for a thirty-six hours' week to assist in the cleansing, and they had done their work most successfully.

Mr. W. H. HAMBLETT (Salford) said he was pleased to learn that engineers were beginning to take an interest in the disposal of clinker. He would not, however, like it to go forth from that conference that the less clinker they had in slab the better the slab was. With regard to standards, these would be very useful. They had often sat at conferences, listened to statements, and taken them back to their homes, only to find that "all that glitters is not gold."

Mr. W. GREIG (Glasgow) paid a high tribute to Bailie Mitchell's interest in cleansing. In Glasgow they found a ready market for street sweepings. The making of slab depended on the nature of the clinker. Clinker well burned should find a ready market anywhere. In Glasgow the demand exceeded the supply.

Mr. J. C. DAWES (Keighley) said that when the Local Government Board tried to standardise results of destructor working, they were so diverse that no one could understand them. They could go to any length in standards. Why not standardise the type of man to sit on committees, and why not take Bailie Mitchell as the standard? (Laughter.) He was surprised to see in the streets the kind of receptacle used for house refuse in Cardiff. At Keighley their bins were placed in a specially constructed bin-house, and not allowed to stand in yards or at the bottoms of gardens. They kept the refuse in a standardised oak tub, which, kept free from the wet, lasted four times the length of the ordinary bin. Mr. Dawes urged that cleansing superintendents should try and manufacture a uniform disinfecting powder.

The PRESIDENT (Mr. W. Harpur), dealing with the question of the collection of waste paper, said the shopkeepers in Cardiff placed their waste paper in bags, and the cleaners collected these bags and took them away. The corporation made no charge for this collection. Previous to the war this waste paper was taken to the marine store dealer, and he paid them 15s. and 10s. a ton, delivered at his premises. At the present time they took the paper to their own depots and people gave them £3 a ton for it. The shopkeepers provided their own bags. As to the collection of ordinary house waste paper, a bag was slung on the back of their refuse carrier, into which the men put the clean paper, brought it back to the depot, and it was sold at the same price. That was an addition they had had since the price of paper had gone up. In Cardiff they had no demand whatever for clinker. They would be glad to give it away. There was no demand even for the manure from the sewage screens. Consequently, manure and clinker were practically wasted. He congratulated Mr. Dawes upon the bin arrangements at Keighley. Except in the main thoroughfares, the refuse collection from private residences at Cardiff was mainly done at night, and they found the arrangement worked exceedingly well.

Bailie MITCHELL, replying to the discussion, said that they had 120 women working in the cleansing department at Glasgow at the present time. They worked from forty to forty-eight hours per week and were paid 6d. an hour. They had 30 tons a week of old paper, and the sale brought in a handsome revenue. In the collection women volunteer reserves had played an important part. They had recesses for putting bins into at Glasgow, the same as at Keighley. Dealing with a remark made by one of the speakers on the previous day, Bailie Mitchell said that at Glasgow they paid good wages in the cleansing department, and they required in normal times able-bodied men. He could never understand how it was that cleansing authorities seemed to hang their heads in connection with the work they were doing. In Scotland their sanitary department was quite apart from their cleansing department, but he recognised that there was a great deal more credit given to the sanitary department than to the cleansing department for the reduced death rate in our cities.

Open-air Bath for Chesterfield.—An open-air swimming bath, presented to the borough of Chesterfield by Alderman C. P. Markham, of Ringwood Hall, was officially opened on Wednesday by the mayor (Alderman E. Shentall).

Galway County Surveyorship.—The Galway County Council are inviting applications for the post of county surveyor for the Eastern Division, at a salary of £350, with an allowance for expenses not exceeding £100. Applications should be sent in by Monday, July 31st.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Dublin T.C.—The city council on Monday adopted a recommendation sanctioning plans for the rebuilding of premises in a number of streets in the area of the recent disturbances. It was stated that the Bill sanctioning the grant of compensation for loss of property, and also a further loan to the corporation for rebuilding, would probably be passed within a fortnight.

Falkirk T.C.—The town council have adopted the recommendation of the electrical engineer for the erection of an engineer's workshop.

Huddersfield T.C.—It was stated by Alderman Smith, chairman of the Housing and Town Planning Committee, that not a single plan for a dwelling-house had been passed during the past month.

Nuneaton T.C.—The acting borough surveyor has been asked to prepare an estimate for repairing, repainting, and re-roofing the bandstand at the recreation ground.

HOUSING AND TOWN PLANNING.

Huddersfield T.C.—Notice has been given of the intention of the town council to apply for authority to prepare three additional town planning schemes.

Newcastle-upon-Tyne T.C.—The city engineer, Mr. W. J. Steele, reports that very little progress has been made in the three town planning schemes, but in the case of Area No. 2 (Walker and part of Heaton) an important decision has been arrived at by providing that the scheme shall include part of a road which will form a direct route between the city and the coast. If the neighbouring authorities include the remaining parts of the road in their schemes, then, instead of the present tortuous and narrow roads with heavy gradients in some places, the new road will be a direct line commencing at Chillingham-road, passing through Longbenton and Wallsend, and terminating at Queen Alexandra-road, Tynemouth. The length of the new road will be about 4¾ miles, and while not decreasing the distance by the present road to any considerable extent, it will not only have no difficult bends, but will have that advantage of vital importance, easy gradient, which governs the load any particular vehicle can carry. A branch road between Wallsend and Monkseaton, about 2½ miles in length, will reduce the distance between Newcastle and Whitley by just over 1 mile.

Selby R.D.C.—The council have replied to a letter of the West Riding Public Health and Housing Committee on the subject of a town planning scheme for Barlow that they do not consider the local circumstances are such that the proposal would be advisable at the present time.

MOTOR TRANSPORT.

Newcastle-upon-Tyne T.C.—The Watch Committee recommend the town council to purchase a new motor fire engine.

Rotherham T.C.—A light motor lorry is to be obtained for the gasworks department.

Stretford U.D.C.—It is proposed to purchase a light motor lorry for the removal of refuse.

REFUSE COLLECTION AND DISPOSAL.

Newport Pagnall R.D.C.—The council have agreed to adopt a combined scheme of scavenging for the three Brickhills, Wavendon, and Woburn Sands. The estimated cost of a central depot is £300, and the annual expense of the work £190. A comparative statement showed the cost to be £27 less than the present system.

ROADS AND MATERIALS.

Barnstaple T.C.—The borough surveyor, Mr. E. Y. Saunders, has received instructions to carry out tar-painting, and to water the side streets.

Bentley-with-Arksey U.D.C.—The council have accepted the offer of the county council to make up the road margin of the tramway track at Bentley.

Burnham U.D.C.—Negotiations are proceeding for borrowing £4,746 for the completion of the sea front improvement scheme.

Farnborough U.D.C.—A tender has been accepted for the supply of limestone macadam at 10s. 10d. and 11s. 10d. per ton.

Greenwich B.C.—Estimates of £3,144 have been approved for resurfacing work and repairs to footways and channels in certain roads.

Herts C.C.—The Road Board have made a grant of £3,500 for tar-dressing sections of the main roads.

Launceston T.C.—The surveyor, Mr. A. W. Grace, reported that the question of damage to road surface, more especially by barred wheel tractors, was a very vital one. The £700 allowed them by the county council was going a very small way towards the damage done by traction traffic.

North Riding C.C.—A sub-committee have reported upon the proposal for a road from Catterick Great Bridge, *viâ* Catterick Camp, to Richmond. The cost is estimated at from £7,000 to £8,000. The county council have adopted the recommendation of the sub-committee that they should decline to take the new road over as a main road. The estimated annual cost of maintenance is £2,000.

Paignton U.D.C.—A scheme is under consideration for the widening of Preston Sands-road.

Westminster B.C.—The Works Committee are asking for authority to spend an additional sum of £1,000 on wood blocks, and to pave Denbigh-street with wood blocks.

Weymouth T.C.—It has been resolved that all streets not tar-sprayed shall be watered as far as possible.

Wilton R.D.C.—The council have reached an agreement with the military authorities through the Road Board for the repair of Devizes-road during the ensuing year on the basis of a grant to the council of the full amount usually provided for ordinary maintenance.—The surveyor, Mr. R. A. Skelton, reported that he had prepared an estimate for the repair of the middle section of the New Cut-road, which had been badly damaged by military traffic. The lower section of the road and the upper section of the road had both been repaired, leaving the centre portion to be dealt with. His estimate amounted to £712. He had communicated with Major Stallard on the matter, and had received a letter from him offering £8 for the work! The clerk read a letter showing that the offer of £8 was arrived at by taking £40 as the annual cost of maintenance of the road. The usual cost of this section would be £16, but the council spent nothing for the two years ending March 31st last, and it was therefore suggested that £8 would cover the cost of repair. The council in declining Major Stallard's offer asked that further consideration might be given to the matter by the military authorities.

SEWERAGE AND SEWAGE DISPOSAL.

Branston R.D.C.—It was reported that the Local Government Board had consented to the modification of the scheme of Boultham sewage disposal works, and that the Public Works Loan Commissioners had agreed to advance a loan of £350.

Clones U.D.C.—A deed has been sealed with the Ulster Bank for a loan of £700 for the purpose of completing the sewerage scheme.

Droxford R.D.C.—It is proposed to carry out flood-prevention works at Hambledon.

Llandilo R.D.C.—An estimate is to be prepared of a proposed scheme for the inclusion of Llandebie in the main sewerage scheme for the Amman Valley.

Sittingbourne R.D.C.—Plans are to be prepared for sewerage works at Rainham estimated to cost £150.

Wombwell U.D.C.—The surveyor, Mr. W. Quest, has received instructions to prepare plans and estimate for sewerage works at Lundhill Fields.

WATER, GAS, AND ELECTRICITY.

Belfast R.D.C.—The council are considering the question of the water supply at Lower Whitehouse, and are meanwhile in negotiation with the Belfast Water Commissioners.

Bideford T.C.—Mr. Moore, of Messrs. Moore, Bateman & Fox, engineers, reporting on a scheme for augmenting the water supply, states that a reservoir of 27,000,000 gallons could be constructed at Jennett's stream, which would be abundantly supplied by the available collecting area, which exceeds 900 acres, and would yield at least 330,000,000 gallons per annum. The water impounded would be pumped to the council's service reservoir on the Buckland road, a distance of about ½ mile, by pumps actuated by engines supplied by gas from a gas-producer plant. The cost of pumping is estimated at about £100 for twenty-four weeks, the probable time required. A sample of the water taken from Jennett's stream was favourably reported on. The town would be wholly supplied from Gammaton reservoir during the six winter months, and it would supply 3,000,000 gallons per month during the summer. The new scheme is designed to provide the remaining 3,360,000 gallons per month during the summer. On the basis of such prices as may be anticipated at the termination of the war, the scheme, including 10 per cent for contingencies, is estimated to cost £13,588. The town council have approved the report and referred it back to the Waterworks Committee for further consideration.

Blackburn T.C.—The Gas Committee recommend an increase of the carbonising plant at the Greenbank works, the construction of a complete tar distillation plant, and the installation of boosting machinery. The estimated cost of the proposed works is £85,000.

Bradford T.C.—Upon the suggestion of the Central Coal and Coke Supplies Committee a conference has taken place between representatives of the city council and the Shipley Urban District Council to consider the question of the inter-connection and joint working of the respective electrical supply undertakings, in view of the increasing difficulty of obtaining coal. After a general discussion the conference found it impossible to decide, on the information before them, whether any very considerable economies could be effected by the linking up of the two systems. It was therefore decided that the two engineers should look into the matter and make reports to their committees, and that after these reports had been considered the representatives of the two authorities should again meet and discuss the question.

Burton-on-Trent T.C.—A scheme has been approved provisionally for lighting the main streets by electricity, the lamps to be suspended at different parts of the tramway routes.

Donaghadee U.D.C.—The Board of Trade have written intimating that they have decided to defer consideration of the revocation of the Donaghadee Electric Lighting Order for a further period of twelve months from August 18th next.

Hull T.C.—The revenue account of the water undertaking for last year shows a nett balance of £17,823, while the nett profit of the gas undertaking fell to £16.

Keighley T.C.—The tenders of the Chemical Engineering Company and Wilton's Patent Furnace Company, at £1,100, have been accepted for a wash-oil distillation plant at the gasworks for the extraction of benzol and toluol, and the tender of Messrs. Clapham Brothers, at £1,028, for a ball-washer scrubber, with accessories.

Lurgan U.D.C.—The Board of Trade have granted the council an extension of time for the completion of electric light mains for a period of one year from August 7, 1916.

Penrith U.D.C.—It has been agreed to increase the price of gas to ordinary meter consumers from 2s. 8d. to 3s. 1d. per 1,000 ft., and to reduce the quantity supplied to prepayment meters *pro rata*.

Plymouth T.C.—The Gas Committee recommend an expenditure of £15,000 upon the purchase of gas stoves, meters, and automatic installations required during the ensuing three years. The electricity revenue account for the year ended March 31st last shows a total income of £59,996, and expenditure £34,782, leaving a gross profit of £25,214. Out of the gross profit all capital charges were defrayed, leaving a nett profit of £2,185, which the committee decided to add to the reserve fund.

Southampton T.C.—It has been decided to make an additional charge of 10 per cent to consumers of electrical energy, making a total advance of 20 per cent.

Wood Green U.D.C.—The council will offer no objection to the North Metropolitan Electric Power Supply Company extending their mains from Taylor's-lane to Wood Green.

MISCELLANEOUS.

Winchester R.D.C.—It has been agreed to make a representation to the Government, to the County Councils Association, and to the Rural District Councils Association, requesting that steps should be taken to amend the Defence of the Realm Act by excluding land and buildings required by local authorities for carrying out their duties, from the provisions of the Bill now before Parliament. By this it is proposed to take powers to retain buildings and land requisitioned for a period of seven years after the war if required. It was argued that great hardship and expense might be caused to the ratepayers if such were the case, especially with regard to the Winchester Hospital taken over by the military authorities on Morn Hill. It was found that compensation did not work out so favourably as appeared on paper.

Surrey C.C.—The council have consented to the placing of seats along the roads at Epsom for the use of wounded soldiers.

PERSONAL.

Mr. J. W. Griffith, engineer-in-chief to the Dublin Port and Docks Board, has resigned.

Dr. Sinclair, the county medical officer, has undertaken temporarily the duties of sanitary inspector of Forfarshire.

Mr. J. W. Madeley, special drainage engineer, Madras, is to be engaged by the corporation for a further term of three years.

Mr. J. S. D. Moffat, manager of the West Ham Corporation Tramways, has been appointed manager of the Belfast system, at a salary of £800 per annum.

Mr. F. Horbury, surveyor to the Ashby, Leicestershire, Rural District Council, has resumed his duties under that authority, having been discharged from the Army medically unfit.

Mr. Alan Bromley, borough surveyor of Godalming, is recommended by the Selection Committee for an advance of salary of £25 as from April 1, 1916, and a further increase of £25 (raising the salary to the maximum of £350 per annum) as from April 1, 1917.

Mr. H. T. Ridge, surveyor to the Romford Urban District Council, is seriously indisposed, and the chief assistant, Mr. W. H. Adams, has been called up for service, the Central Tribunal having dismissed an appeal made on his behalf. The urban council have decided in the circumstances to ask the tribunal to review the case.

OBITUARY.

Mr. J. Westerby, surveyor to the Whitley Upper (Yorks) Urban District Council, died recently, we regret to state. The council have appointed as his successor Mr. Abraham Hardy, the assistant surveyor.

FOR OTHER ADVERTISEMENTS

See End of Paper.

COUNTY BOROUGH OF BLACKBURN.

WANTED at once, Temporary Draughtsman for Waterworks Department. Must be ineligible for Military Service. Apply, stating salary required, experience, and full particulars, to the Borough and Water Engineer, Town Hall, Blackburn. (3,056)

SURREY COUNTY COUNCIL.

COUNTY SURVEYOR'S DEPARTMENT.

Temporary Assistant (ineligible for Military Service) required with a knowledge of Surveyor's accounts, shorthand, and typewriting. Salary £3 per week. Applications and testimonials to reach the undersigned by Friday, 11th August.

A. DRYLAND,
County Surveyor.

County Hall,
Kingston-on-Thames. (3,057)

WANTED, THE SURVEYOR, Vols. 24 to 42 inclusive, and Vol. 44, in publishers' cases or unbound. Offers to the Publisher, office of THE SURVEYOR, 24, Bride-lane, Fleet-street, E.C.

WANTED immediately, sell or hire, 6 to 8-ton Steam Roller, good working order. Full particulars, and lowest cash, to Box 1,579, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,058)

INSECTS AND DISEASE.

THE NATIONAL LEAGUE'S CAMPAIGN.

The National League for Physical Education and Improvement again call public attention to the campaign against insect pests.

This league began an anti fly and vermin campaign last summer, and are again invoking the aid of the numerous organisations which last year carried out educative work to help them to wipe out insect pests. The movement has obtained the support of and promise of help from the most influential of organisations—religious, municipal, and social. Sir Frederick Treves writes:—

"I am glad to see that the movement for the prevention of the spread of epidemics by insects is making such vigorous progress. The matter is one of the greatest moment, while the remedy is in the hands of the people themselves. It is not so much a matter of combating flies as of overcoming the ignorance of those who regard flies merely as an annoyance. Flies and other vermin constitute a positive and acute danger. The human being who 'would not hurt a fly' is a menace to the public health and the product of a pernicious ignorance."

Experience and experiment show that flies have regular breeding places, such as manure heaps, and if steps are taken to keep these covered in earth (which incidentally enhances the manurial value), a considerable blow is struck at the fly pest.

Closely associated with the fly problem is the question of dust collection in London. According to the league, the most advanced local authority in the administrative area of London is the Corporation of the City of Westminster. In no other borough is there a daily collection of household refuse. Another field of hygiene in which this corporation take a leading place is in instituting a system of assistance and advice in combating any discovered outbreak of vermin. Disinfection is done by the council's men without cost and without fuss. In these abnormal times houses hitherto free from such inflictions are sometimes confronted with the problem, and this expert aid is at the disposal of the residents of Westminster.

The National League through the many channels invoked in the cause are distributing thousands of leaflets for the education of the masses. The rules laid down are simple and summary: Kill all flies; screen all food; burn animal and vegetable refuse; keep the dustbin covered and dry.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

The Use of Crude Tar for Roads.—The March Urban District Council received recently a letter from the Ministry of Munitions asking for an immediate explanation of their action in using crude tar for road purposes, an action "contrary to the regulations, and which, by involving a waste of raw materials required for the manufacture of explosives, is opposed to the national interests." The clerk was directed to reply that the council had only received "suggestions" not to use crude tar, and to give an assurance that no more would be used.

Brighton Electricity Undertaking.—According to the accounts of the Brighton Corporation electricity undertaking for last year, there was a loss of £3,989, in consequence of the abnormal increase in the price of coal. Although the sales of electricity dropped, a revision of the tariff resulted in an increased revenue of £459. It is proposed to defray the deficiency from the reserve fund, but the Finance Committee point out that if this fund was written down to current values it would be insufficient to meet the call by approximately £1,000. Owing to the restrictions on street lighting, the revenue was depleted by £7,000, and £2,102 was paid in war allowances to the staff.

* **A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.**

THE COST OF REFUSE DISPOSAL.*

By W. J. Steele, M.Inst.C.E.,
City Engineer of Newcastle-on-Tyne.

The popular opinion that a profit can be earned in the disposal of city refuse, or that at least the present nett expenditure can be appreciably reduced, is questionable; the enormous bulk in comparison with any value it may possess renders the income derived from the sale of its usable components a very small proportion of the cost of handling it.

Probably the most simple and effective means of assisting the solution of the problem would be that the failure on the part of any householder to burn all vegetable and similar garbage from his establishment should be an indictable offence. Some improvement has been effected in this direction voluntarily in Newcastle-on-Tyne, but a very large quantity of garbage which could easily be burnt by the householder is still collected.

If all burnable refuse were dealt with by the householder there would be no necessity to pass the resultant matter through the public destructors, which undoubtedly are effectual machines from the public health point of view, but they are costly to instal and maintain.

Destructors will always be required to deal with the refuse from markets, slaughter-houses and similar institutions, but at the present time, during the winter particularly, large quantities of ashes are again passed through the furnaces at the destructors owing to their being mixed with garbage; if such garbage were eliminated the ashes could be deposited direct on local tips without any treatment, and thereby reduce to a very considerable extent the volume of refuse dealt with at the destructors.

In Newcastle-on-Tyne, during the year ended March 31st last, 133,296 tons of refuse were disposed of; 50,853 tons being deposited on tips, 37,413 tons burnt at the destructors, 24,528 tons sent to sea, and 20,502 tons sent by rail to various farms. The house refuse amounted to 98,324 tons, which is equivalent to 7·07 cwt. per head of the population, or 38·49 cwt. per house, and the cost of collection and disposal was 22·85d. per head of the population, or 10s. 4·39d. per house. The street refuse amounted to 34,972 tons—an average of 138 tons per mile of highway cleansed.

About four years ago the practice of making a separate collection of waste paper was abandoned, owing to the income derived therefrom being less than the expenditure, but with the greatly increased price paid for waste paper the work has now been resumed. At the present time about 5¼ tons are being collected, sorted and baled each week at a nett profit of about £3 per week.

* Extract from annual report.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Derby T.C.—£9,000 for electricity mains and motors.

Loughborough T.C.—£7,000 for the construction of an electric cable.

LOANS SANCTIONED.

Abercarn U.D.C.—£800 for a dehydration plant at the gasworks.

Huddersfield T.C.—£4,000 for the erection of houses.

Killarney R.D.C.—£3,300 for labourers' cottages.

Merthyr T.C.—£15,000, expenditure in connection with the Taf Fechan reservoir.

Wembley U.D.C.—£950 for sewerage works at North Wembley.

Bethnal Green War Bonuses.—Bethnal Green Borough Council are recommended by a special committee to grant a war bonus of 3s. per week to all permanent officers in receipt of a salary not exceeding £200 per annum, except in the case of joint appointments, where the joint salary (excluding emoluments) does not exceed that amount, when the bonus shall be 1s. per week.

LOCAL AUTHORITIES AND OMNIBUS ROUTES.

THE NEW POWERS UNDER THE EMERGENCY ACT.

At the monthly meeting of the Western District Committee of Stirling County Council application was made by two Glasgow motor hirers, under the Local Government (Emergency Provisions) Act, for permission to run motor buses over the roads of the District Committee from Glasgow to Aberfoyle.

Mr. Ripley Ker said if they had power to stop or discourage these motors, he thought they should do so, because of the great damage they were doing to the roads, and the necessity for conserving the petrol supply.

Mr. Watson Murray agreed as to the damage to the roads, but he did not think they should prohibit the traffic, as it was brought out to the country at the week-ends many munition workers who were fully engaged all the rest of the week. At the same time, he thought the owners should contribute something to the upkeep of the roads. It was mentioned that in the Central District 1d. per ton mile was imposed. It was referred to the Roads Committee to consider the matter.

In the minutes of the Highways Committee of the Eastbourne Rural District Council, it was stated that the clerk drew attention to the fact that the Eastbourne Corporation, in addition to prohibiting certain roads for the return journeys of local motor char-à-banc, had recently granted three licences to the Southdown Motor Services, Limited, to run motor coaches between Eastbourne, Seaford and Brighton, subject to the vehicles not entering the town by certain routes, which would entail a still further increase of such heavy traffic over the district roads. The surveyor, Mr. W. Walker, reported that he was taking a census of this traffic at Jevington.

After discussion, it was resolved that the clerk be authorised to confer with Mr. A. J. Lees, Parliamentary agent, and, if necessary, the Local Government Board, and ascertain the position of the council in regard to dealing with such user of district roads.

At the meeting recently of the East Westmorland Rural District Council, the clerk, Mr. W. Hewitson, reported that he had received from the county council the regulations under sec. 20 of the Local Government (Emergency Provisions) Act, 1916, relating to omnibus routes. The letter suggested that the various highway authorities in the county should get the county council to act for them in that matter. It would be difficult, it was explained, for each authority to act by itself, and the larger body would be in a better position to do what was necessary. The clerk stated that there was also a communication from the Lancashire County Council suggesting the combination of counties for the purpose, and to provide through roads from one county to another. Mr. Milne, clerk to the Westmorland County Council, suggested that rural and urban councils should adopt a resolution requesting the county council to act for them in the matter.—Mr. J. Kilner, highway surveyor, said he thought that would be the better course, but at the same time it was a moot point whether each separate authority should be represented on any committee that was appointed to carry out the object. Small authorities should retain some hold over their own highways. It would, however, be a great mistake for individual districts to act singly. The clerk said the suggestion was that the local authorities should delegate their powers to a central authority.—After further discussion it was decided to adjourn the matter for consideration at the Kirkby Stephen meeting.

Electricity Supply at Holmfirth.—The Holmfirth Urban District Council electricity undertaking was formally opened recently. The buildings are of sufficient size to allow for three generating plants—two of 100 kilowatts capacity and one of 60 kilowatts—but the present plant is for 160-kilowatts only. The power is supplied by two gas engines, and there is a suction gas plant. The battery is arranged with tanks of sufficient size to contain eleven plates having an output of 345 ampere hours. The mains for distributing the energy are arranged upon the three-wire system, carried upon steel poles. The streets will be lighted by electricity, and the council are making a start with thirty-one private consumers.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTH-WESTERN DISTRICT MEETING.

A South-Western District meeting of the Institution of Municipal and County Engineers is to be held at Exmouth to-morrow (Saturday).

PROGRAMME.

3.0 p.m.—Meet at council offices, where Mr. County Councillor Crews, chairman Roads Committee, Exmouth Urban District Council, will receive the members.

Read minutes of previous meeting.,

3.15 p.m.—Proceed to the Marine Drive Works for inspection, where Mr. Hutton will describe the works. The works comprise: Just completed, approximately ½ mile of bulk concrete sea-wall, built by Lord Clinton (Engineers, Messrs. Douglass, Lewis and Douglass); approximately ½ mile of reinforced concrete and masonry sea-wall, built by the Exmouth Council (engineer, Mr. S. Hutton).

In connection with the above and now in course of construction by the Exmouth Council: Approximately 1 mile of reinforced concrete carriageway, 40 ft. wide, with 25 ft. of footpaths (engineer, Mr. S. Hutton).

Arrangements are being made with the contractors to keep the men working during the inspection.

5.0 p.m.—Tea at the Undercliff Tennis Pavilion (adjoining the works) by invitation of Mr. Crews and Mr. Hutton; after which Mr. Hutton will be glad to answer any questions arising out of the inspection.

EASTERN SUB-DISTRICT MEETING.

An Eastern Sub-District meeting (Norfolk, Suffolk and Cambridge) will be held at Sheringham to-morrow (Saturday).

PROGRAMME.

12.30 p.m.—Meet at council offices, where Mr. H. R. Johnson, J.P., chairman of the Sheringham Urban District Council, will receive the members.

Read minutes of previous meeting.

Paper on "Nine Years' Work at Sheringham," by Mr. F. Hall Smith.

1.30 p.m.—Lunch at the Sheringham Hotel. (Tickets 2s. 6d. each.)

2.30 p.m.—Resume discussion—especially Nationalisation of Coast Protection.

3.30 p.m.—Inspect Protection Work, Shelters, &c.

4.30 p.m.—Afternoon tea at "Ormesby," by invitation of Mr. F. Hall Smith.

JOHN R. MEAD,
Hon. Sub-District Secretary.

Ipswich.

A Hampstead Demolition Order.—In the House of Commons last week the President of the Local Government Board was asked whether he was aware that the board had intimated their intention of confirming a demolition order made by the Hampstead Borough Council under sec. 17 of the Housing, Town Planning, &c., Act, 1909, in reference to a house in Palmerston-road, Kilburn, although the house had been certified by experts to be perfectly fit for human habitation in every respect; and whether the board would refer the matter to the president of the Surveyors' Institution, the president of the Royal Institute of British Architects, or the president of the Medical Officers' Association for report. Mr. Long, in reply, said that no intimation had been given of an intention to confirm the demolition order referred to. On an appeal by the owner against the Order, the department had intimated that they were of opinion that the making of the Order by the borough council was justified, but they were also giving the owner an opportunity of remedying the defects which had caused the house to be considered unfit for human habitation. He was advised in all these matters by very experienced officers, and he saw no reason to refer this particular matter for report to any of the gentlemen mentioned in the question.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ

(One man does not see everything.)

—Euripides.

THE INSTITUTION MEETING AT BLACKPOOL: ORPHAN FUND.

To the Editor of The Surveyor.

Sir,—I quite agree with Mr. Frank Massie's letter in your columns last week, suggesting that surveyors who attended the meeting at Blackpool should send on their subscriptions at once to the hon. treasurer, Mr. O. Claude Robson, Municipal Offices, Dyne-road, Kilburn, London, N.W., to make up the regrettable loss that has been incurred to the Orphan Fund through no collection being made at that gathering. If ever there was a time when this fund is needed it is now. The drain upon it will be enormous.

Members should act promptly and send a subscription to-day. By the time this letter appears Mr. Robson will have received mine.—Yours, &c.,

Oswald A. Bridges,
Town Surveyor.

Council Offices,
Bognor, Sussex.
July 24, 1916.

Road Surveyors' War Bonuses.—Holland County Roads and Bridges Committee have recommended the payment to each of the district main road surveyors of a war bonus of £60 per annum for motor cycle allowance and other expenses.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR AND INSPECTOR.—July 29th.—Darfield Urban District Council. £120 per annum.—Mr. W. Robinson, clerk, 17 Regent-street, Barnsley.

ASSISTANT SURVEYOR.—August 2nd.—Elland Urban District Council. £140 a year.—Mr. J. Clarkson, clerk, Council Offices, Elland.

SEWAGE FARM MANAGER.—August 5th.—East Barnet Valley Urban District Council. £2 2s.—£2 10s. per week.—Mr. T. A. Buckley, clerk, Council Offices, Station-road, New Barnet.

TEMPORARY MAIN ROAD SURVEYOR.—August 19th.—Cornwall County Council. £150 per annum.—Mr. L. D. Thompson, county surveyor, County Hall, Truro.

TEMPORARY ASSISTANT SURVEYOR.—Corporation of Tenby. 30s. per week.—Mr. B. Morley, borough surveyor, Tenby.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

GRIMSBY.—July 31st.—For the erection of a temporary fire station, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor, Municipal Buildings.

FALMOUTH.—July 31st.—For building a sea wall, for the corporation.—Mr. H. E. Tresidder, borough engineer and surveyor, Municipal Offices.

WEST HARTLEPOOL.—August 1st.—For building a boiler-house, for the corporation.—Mr. N. F. Dennis, borough engineer and surveyor.

MANCHESTER.—August 2nd.—For laying a wood block floor, for the Board of Guardians.—Mr. A. J. Murgatroyd, architect, 23 Strutt-street, Manchester.

BRIDGNORTH.—August 10th.—For work in connection with the construction of a wall at Winterburn Bridge, for the rural district council.—Mr. F. Richards, surveyor Oldbury, Bridgnorth.

Engineering: Iron and Steel.

DEWSBURY.—August 3rd.—For the supply of steam piping and fittings, for the Board of Guardians.—Mr. C. P. Pickersgill, clerk, Union Offices, Wellington-street, Dewsbury.

HALIFAX.—August 5th.—For the reconstruction in reinforced concrete of Clark Bridge, for the corporation.—Mr. J. Lord, borough engineer, Town Hall.

SINGAPORE.—August 14th.—For the construction of a steel bridge, for the Public Works Department.—Chief Clerk, Colonial Engineer's Office, Singapore.

Roads.

BERKHAMSTED.—July 31st.—For the supply of flints, for the urban district council.—Mr. J. R. Hadfield, surveyor, 135 High-street, Berkhamsted.

BROADSTAIRS.—July 31st.—For the supply of 500 cubic yards of pit flints, and 160 cubic yards of pit gravel, for the urban district council.—Mr. H. Hurd, surveyor.

TOTNES.—August 1st.—For ripping and breaking stone and hauling, for the rural district council.—Mr. H. Vickery, highway surveyor, Antrim-terrace, Totnes.

NORTHWOOD.—August 1st.—For the supply of 700 tons of tarred slag macadam, 600 cubic yards of hand-picked brick or good concrete hardcore, and clean clinker, for the urban district council.—The Surveyor.

LEATHERHEAD.—August 1st.—For the supply of 130 tons of 2½ in., 60 tons of 1¼ in., 15 tons of ⅜ in. of slag macadam, and 8 tons of slag dust, for the urban district council.—Mr. Sidney R. Drake, surveyor, Council Offices.

ALDERSHOT.—August 1st.—For the execution of haulage work, for the urban district council.—Mr. F. C. Uren, surveyor, Municipal Buildings.

BASINGSTOKE.—August 10th.—For steam rolling, for the rural district council.—Mr. R. Forrester, surveyor, Chequers-road, Basingstoke.

ROMFORD.—August 14th.—For the supply of 920 tons of granite, for the rural district council.—The Highway Surveyor, 16a South-street, Romford.

JOHANNESBURG.—August 14th-15th.—For the supply of 1,600 tons of tar or tar substitute, for the municipal council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

LONDON.—August 15th.—For the supply of 370,000 creosoted deal paving blocks, for the county council.—Chief Officer, L.C.C. Tramways, 62 Finsbury Pavement, E.C.

Sanitary.

LANCHESTER.—July 31st.—For cleansing closets and ashpits, for the rural district council.—Mr. J. R. Lupton, surveyor, Lanchester.

TICKHILL.—August 1st.—For the removal of house refuse, for the urban district council.—Mr. J. Walker, clerk.

Stores.

GOSPORT.—August 10th.—For the supply of artificial stone paving, broken stone for macadamising, brooms, castings, cement, lime, disinfectants, stoneware pipes and ironmongery, for the urban district council.—The Surveyor, Town Hall.

ROCHESTER.—September 5th.—For the supply of road metal, brooms, horse hire, and tools, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

Miscellaneous.

WARRINGTON.—August 2nd.—For the supply of a two-stroke motor bicycle, for the corporation.—Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

HOLLINGBOURN.—August 3rd.—For rebuilding the side of a bridge, and erecting oak fences, for the rural district council.—Mr. H. J. Bracher, clerk, 33 Earl-street, Maidstone.

PLYMOUTH.—August 7th.—For the supply of a motor van, for the corporation.—Chief Constable, Central Police Office.

WARSOP.—August 14th.—For laying out a portion of the new burial ground, for the urban district council.—Messrs. Vallance & Westwick, White Hart-chambers, Mansfield.

The Surveyor

And Municipal and County Engineer.

Vol. L. AUGUST 4, 1916. No. 1,281.

Minutes of Proceedings.

The Sheringham Meeting: Coast Protection.

A highly successful meeting of the Eastern Sub District of the Institution of Municipal and County Engineers was held at Sheringham last Saturday, when a paper descriptive of the municipal works of the district was read by Mr. F. Hall Smith, P.A.S.I., the surveyor to the urban district council. Sheringham is charmingly situated on the Norfolk coast, and in recent years has made considerable strides as a watering-place. The manner in which the development of the town has been guided by the council and its officials reflects no little credit on all concerned, and augurs well for increased prosperity with the return of normal conditions on the East Coast. For example, it may be mentioned that the sewerage system is constructed on modern lines; the building by-laws were revised two years ago; new council offices have been recently erected; and adequate public conveniences have been provided. It is perhaps worthy of note that the revised by-laws contain a provision exempting reinforced-concrete walls from the thickness required for brickwork, provided that they have the strength necessary to secure due stability. This form of by-law ought at least to be satisfactory to the council, as it apparently leaves them to say in each case whether the proposed construction complies with the by-law.

Both in Mr. Hall Smith's paper, and in the discussion which followed, considerable attention was given to the subject of coast protection, which is of supreme importance locally. The original sea wall and promenade at Sheringham were constructed in 1899-1900, at a cost of £19,950. Nine years later it was found necessary to extend the wall over a hundred yards eastward to the East Groyne, as the sea was getting behind the old works. This was carried out by direct labour, at a cost of £1,155. Further works were again found to be necessary after the great rainstorm of August, 1912, which caused so much damage in Norfolk. On that occasion no less than 5½ in. of rain fell at Sheringham, and the lower portion of the cliffs at the west promenade were washed on to the beach. To meet this situation Mr. Hall Smith recommended the construction of a raised promenade and shelter, the total cost, excluding the shelter, being £765. The effect of the cost of these sea defence works on the rates may be fairly estimated if it is borne in mind that the present rateable value of the district is approximately £23,000, a penny rate producing less than £100. It is hardly surprising therefore that Mr. Hall Smith should have concluded this part of his paper with a plea for some form of Government assistance towards works of coast defence, which, after all, are of national as well as local importance. Sheringham does not stand alone in this matter, as was clearly shown by the trend of the discussion. For example, Mr. J. S. Hurst, in expressing agreement with Mr. Hall Smith's views as to Government aid, pointed out that Southwold has up to the present sunk a capital sum of £23,500 (considerably more than the rateable value of the town) in fighting the sea, this amount not including any elaborate promenades, but being simply for necessary works. It will be seen therefore that in the case of small seaside towns on the East Coast the burden placed on the rates by the execution of necessary coast defence works is wellnigh intolerable. It may be said that the value of the land saved is not worth the cost involved, but surely this is rather a narrow view to take. It must be remembered that when once land has been lost to the sea it can never be regained. The predominant interest is, of course, the local one, and it is not suggested that the whole cost of sea defence works should be charged to the national exchequer. Unless some measure of assistance is given, however, the result must be that no work at all will be undertaken in many districts, while in others financial considerations will lead to an undue restriction. Even where, as at Sheringham, a bold policy is undertaken, the resulting burden is such as no body of local ratepayers in a small town ought to be called upon to bear unaided.

* * *

Progress in the Treatment of Sewage.

The brief, but excellent, review of the history of sewage disposal which was given by Dr. Barwise in his presidential address at the recent annual summer conference of the Association of Managers of Sewage Disposal Works at Sheffield, led up to, and dealt largely with, the latest method of treatment by

means of activated sludge. One of the other two papers read at the same meeting gave some very interesting results of experiments carried out at Sheffield with the same process. From these two papers, which appeared in our issue of July 14th, it will be seen that aëration, or the blowing of air into the sewage, is actually only needed for the purpose of activating the sludge. In most cases, up to the present, air has been used both for activating the sludge and for bringing it into intimate contact with the whole of the sewage, and this has without doubt been the cause of the comparatively large volumes of air required, and consequently of the high cost of the process. Dr. Barwise holds the view that the amount of air used by this method is in excess of what is required for aëration. Mr. Haworth, the author of the second paper, who is manager and chemist of the sewage disposal works at Sheffield, after carrying out various experiments in the aëration of the effluents from primary contact beds by what may be termed the older methods, and later with the addition of activated sludge, came to the conclusion that as only a small proportion of the air is used for oxidation in activating the sludge, and the larger proportion for mixing the sludge with the sewage, it might prove to be more economical to use mechanical means for the latter purpose. He then devised an ingenious apparatus, described in the paper, by means of which the sludge and sewage are continuously being mixed, and at the same time a small definite quantity of air is carried into the liquid at regular intervals, all by mechanical means and without the use of an air compressor. Mr. Haworth claims that the results of this experiment show that the aëration by minute bubbles of air, such as through porous tiles, is unnecessary, and that mechanical circulation, combined with minimum aëration, is efficient. Although the mechanical apparatus devised by Mr. Haworth is small, and may need considerable modification before it can be adapted for dealing with large volumes, it confirms the principle of the process as already established, and demonstrates that the use of compressed air is not essential. This is a great step in advance, and, as stated by Dr. Barwise in his address, it opens up a new field for thought. Instead of confining their attention to overcoming the difficulties which had arisen in the economical application of compressed air for activating the sludge and thoroughly mixing it with the sewage, engineers may now turn their energies in the directions indicated by Dr. Barwise. Some of the older methods of aëration, combined with mechanical agitation of one sort or another, may be found to be suitable, and the greater the number of experiments that are made, even if many of them fail to secure entire success, the sooner shall we arrive at a method, or combination of methods, which will prove to be both efficient and economical.

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Animals Straying on the Highway.

The question of the liability of the owner of animals straying on the highway for an accident caused by their presence is one that has been the subject of several judicial decisions. Under sec. 25 of the Highway Act, 1864, the owner of certain specified animals found straying or lying on any highway is liable to a penalty not exceeding 5s., plus the expense of removing the animals either to the owner's stable or to the common pound. But this is the only liability imposed by this enactment, and it applies indiscriminately, whether any accident or damage has been caused or not, and irrespective of any question of negligence. In *Hadwell* v. *Righton* (1907, 2 K.B., 345) an accident was caused to a cyclist by some fowls which had been frightened by a dog, and it was held that the owner of the fowls was not liable, the accident not being the natural consequence of their being on the road. In *Higgins* v. *Searle* (100 L.T., 280) the Court even went so far as to say that an animal straying on the highway is one of the ordinary risks taken by users of the highway. In *Ellis* v. *Banyard* (1911, A.C., 10) a cyclist was injured by some cows which had strayed through an open gate, and it was held that, in the absence of proof of negligence, the owner was not liable. And in *Jones and Another* v. *Lee* (28 T.L.R., 92), where a horse escaped from a field, owing to defective hedges, and injured a pedestrian, the owner was absolved from liability.

The question again came up for consideration in the recent case of *Heath's Garage, Limited, and Another* v. *Hodges*—noted in our issue of June 30th—which is of considerable interest. This was an action for damages for injury to the plaintiff's motor-car by a sheep belonging to the defendant under the following circumstances: The car was being driven along a public highway near Kenilworth, at the moderate pace of between 16 and 20 miles an hour, when the driver saw on the road, about 200 yds. ahead, a number of sheep (which had strayed from the defendant's land through a gap in his fence). The driver put on his brakes, and most of the sheep got to one side of the road, but two jumped from a bank on the near side, and one of these collided with the car and damaged the steering gear. The defendant was convicted and fined under sec. 25 of the Highway Act, 1864, but, of course, this in itself was not proof of negligence on his part, since that section applies (as already indicated) to the owner of sheep (and other specified animals) found straying or lying about on a highway, whether the animal's presence is attributable to any negligence on the part of the owner or not. The judge of the Warwick County Court held that the defendant had been guilty of negligence, or at all events of committing a nuisance in allowing his sheep to stray on to the road, and that the accident was the natural consequence of such negligence, and he gave judgment for the plaintiffs. This decision, however, was reversed by the Divisional Court, and such reversal was affirmed by the Court of Appeal. In delivering judgment in that Court, Lord Cozens-Hardy cited *dicta* showing that, at common law, the owner of land adjoining a highway is not under any obligation to fence his land, so as to prevent animals from straying on to the road, and that in ordinary circumstances there is no duty to prevent harmless animals like sheep from straying on to the highway. It was true, said his lordship, that under the Highway Acts, 1835 and 1864, penalties might be imposed on anyone whose cattle were found straying on the road—that was a new remedy given for the protection of the public—but it did not render a man liable to an action at law; the fine imposed by the justices was the only remedy available. To the plaintiffs we should think this last suggestion must sound rather a mockery, and there seems to us to be something anomalous in the state of the law with respect to this matter as laid down in this case.

* * *

An Important Question.

On Monday last Mr. Justice Bray concluded the hearing of the case of the *Metropolitan Water Board* v. *Messrs. Dick, Kerr & Co., Limited*, which arose out of the action of the Ministry of Munitions in temporarily stopping certain works so as to divert the labour to Government work for the period of the war. It appears that in July, 1914, the defendants contracted to construct for the plaintiffs certain works known as the Littleton reservoirs. They began the undertaking and continued at work until February, 1916,

when they were stopped by the Minister of Munitions, acting under the Defence of the Realm Act. Being unable to continue, they now contended that the contract was at an end; but the plaintiffs wished the contract to remain in force and asked for a declaration that it was still in existence and binding. A further point raised turned on a clause in the contract which provided that tools, plant, and materials brought on the site by the defendants should become the property of the plaintiffs until completion of the work, and should not be removed without the plaintiffs' consent. The defendants had disposed of certain tools, plant, and materials which they had had on the site before the stoppage, and the plaintiffs asked for damages for conversion. By their defence, the defendants contended that by reason of an order to stop work received from the Minister of Munitions they could not go on with the contract. Its further performance became impossible and illegal, and it came to an end.

The actual facts in regard to the stoppage were that on February 21, 1916, the Minister of Munitions gave notice to the defendants that they were not to employ any more workmen for the time being, as they were wanted elsewhere. Certain machinery and material, for which the sum of £40,000 was received, were also requisitioned and sent to various parts of the country. In the result, his lordship held that the contract was not abrogated, that under Clause 10 all the plant which came upon the site became the limited property of the board, and that defendants were not bound to repay the money already received from the Ministry of Munitions. He granted an injunction against Messrs. Dick, Kerr & Co. removing any machinery or receiving the proceeds of the sale of any machinery removed, or which might hereafter be removed, except so far as they were acting under the order of the Ministry of Munitions. The decision is of very great importance to local authorities, and particularly to the Metropolitan Water Board, as that body has several other large works in hand which have been stopped under similar circumstances.

* * *

Surveyors and Highway Policy.

The question of highway policy and the position of the surveyor in connection therewith was discussed recently (we gather from the *Coventry Herald*) by the Meriden Rural District Council upon a report from the Highways Committee, giving details of certain works. The exact point at issue was the extent to which in the present abnormal circumstances it is necessary or desirable to limit the work of tar-painting. The report of the committee was based upon the necessity for immediate economy, and it was vigorously opposed by certain members on the ground that, although tar-painting unquestionably involves immediate expense, that expense is justifiable in view of the ultimate saving upon road maintenance. It will be readily understood that we have not the least desire to quarrel with this view, but at the same time it was distinctly unfortunate that its advocates should have attempted to make the discussion an opportunity for attacking the surveyor. It appears that the committee in reporting as they did were influenced by the request that has been made by the Government for restriction in the use of tar, and in spite of this fact it was suggested by certain members that it was the duty of the surveyor to dictate to the committee, and that he was in a measure personally responsible for the report. One member went so far as to express the opinion that the surveyor should do something to bring the matter definitely before the council and get their decision; and this, apparently, in spite of the fact that the council already had under consideration a report of their Highways Committee on the subject. Whatever view may be taken as to the correctness of the opinion expressed in the report of the committee, we imagine that it will be generally agreed that in a matter of policy of this kind it is no part of the duty of an official to report to the council behind the back of his committee, even if he thinks the latter body to be in the wrong. The proper course to be followed by the council if they require a report from the surveyor direct to themselves is obviously to pass a resolution to that effect and to take the matter out of the hands of the committee to which it has been referred and with whose report they may disagree. It is satisfactory to observe that the attack on the surveyor did not succeed, and that the report of the committee was ultimately adopted.

* * *

Branston Rural Surveyors Under the Harrow.

The surveyors to the Branston, Lincs, Rural District Council have been evidently experiencing lately a sample of the tender mercies of the local councillor clothed in brief authority. With reference to certain proposed new works in the district, the War Office, through a divisional officer, requested that the council's surveyor, Mr. T. R. Howitt, should undertake the duties of clerk of the works, and it was recommended that he be paid £46 per annum, the difference between his Army pay and his present salary. The surveyor told the council that he would have ample time to devote to certain council work, and manifestly the proposed bargain was not a bad one for the council or for the nation. Even this fact could not restrain a councillor from indulging in a series of sneers, during which he remarked sarcastically that it was a "very good arrangement" (for the official), and that he "was only thinking it would be too economical for the War Office." Then another member chimed in with the graceless remark that as the other surveyors "had very little to do" they might have liberated Mr. Howitt and done the work themselves, which the councillor who first spoke agreed with. This elicited a protest from Mr. J. W. Watson, one of the surveyors concerned, and Mr. Howitt backed him up in replying to other criticisms, saying it was evident that one of the critics knew nothing about the work he had to do. This tempted the councillor to a Parthian rejoinder that "he still maintained Mr. Howitt had a far better job than most surveyors. He had a very good job. If he could get a better he would be gone to-morrow." Considering what they have to put up with from councillors, it would not be surprising if the Branston surveyors acted upon this latter suggestion; but meanwhile it is at all events consoling to note that they follow the commendable practice of countering abuse with a dignified and spirited defence.

Electricity Supply Economies.—In the House of Commons the Secretary to the Board of Trade was asked whether a circular had been issued by his department urging an arrangement to merge electrical supplies with a view to saving coal. Had he considered that new cables and other expense might be necessary to enable such plans to be carried out, involving capital expenditure; and would enabling legislation be introduced to render possible the desirable economies which the Board of Trade wish to effect in cases where statutory authority would be required? Mr. Harcourt said the answer to the first two portions of the question was in the affirmative. In issuing the circular the Board of Trade had not in mind any large schemes of interconnection involving heavy capital expenditure and a large use of material, but rather contemplated arrangements between undertakers whose areas of supply adjoined, or nearly so. He did not think that legislation for this purpose was requisite, but should the necessity for it appear to arise, he would be prepared to give the matter full consideration.

Sea Front Improvement at Exmouth.

A NEW MARINE PARADE.

Exmouth's New Marine Drive.

Since his appointment some thirteen years ago, Mr. Samuel Hutton, in his capacity as surveyor and water engineer, has done much to add to the attractiveness of Exmouth from the point of view of the holiday maker. Evidence of his activities was not wanting when in May, 1912, the members of the Institution of Municipal and County Engineers paid a visit of inspection to the town, and the intervening period, despite the advent of the war, would seem to have witnessed no diminution of his efforts. At the present time he is engaged in the carrying out of an important work of improvement in the shape of a new marine drive, which, when completed, will be a lasting monument to his skill as an engineer and to the enterprise of the local authority whom he serves with such conspicuous ability. The magnitude of the undertaking will be appreciated when it is stated that a sum of more than £30,000 will be expended in its execution; and in no small measure the carrying out of the scheme has been made possible by the generosity of Lord Clinton, the owner of the foreshore and beach. The new work is divided into three sections, one part, built by Lord Clinton, consisting of a bulk concrete wall about half a mile in length, with certain sloping of the cliffs; a second part, built by the urban council, consisting of a reinforced concrete and masonry sea wall of approximately the same length; and the third part, the construction of a reinforced concrete carriageway about a mile in length with concrete footpaths (partly reinforced) behind the two walls, this also being carried out by the council under the supervision of Mr. Hutton. Both walls have been carried down to the same level—viz., 2 ft. below ordnance datum, or low water neap tide level.

The wall constructed by Lord Clinton was begun in the spring of 1915 and completed last summer, while that undertaken for the council, which adjoins his lordship's wall, was commenced in May last year and finished a little over two months ago. The former wall is of mass concrete construction and affords a good example of heavy concrete work. The sloping of the cliffs, which has presented the usual difficulties in dealing with marl formation, is on the point of completion, and there is every evidence that the sloping will be effectual and at the same time will not have seriously destroyed the rugged appearance of the high land, so much a feature of the scenery in this part of the country.

The council's wall is of the slope type. The protection of the base is of reinforced concrete sheeting, the reinforcement being expanded metal mesh, supplied by the Expanded Metal Co., Limited, Westminster. The whole of the trench was excavated and the sheeting constructed in situ, thus avoiding the gaps which are common where piles are driven into beach gravel. From the beach the work is faced with rough limestone, reinforced with expanded metal and surmounted by a rounded parapet, which is about 2 ft. 6 in. above the promenade footpath. Bastions placed at regular intervals give an effective appearance to the wall, while stepways and a slipway give access to the beach.

Before the carriageway and footpaths behind the walls were begun, a trial section was laid down, and was subjected to a year's traffic, during which time 1,500 tons passed over it. The concrete is being laid on the sand to a depth of 5 in., reinforced in the centre with expanded metal laid longway of mesh from kerb to kerb. The sheets are overlapped not less than one mesh at joints to obtain continuity of reinforcement and the overlaps are not made in continuous lines, but are staggered. By the use of expanded metal reinforcement it is calculated that something like 4 in. of additional concrete has been dispensed with. The width of the carriageway is 39 ft. 6 in., while the footpaths cover an additional 25 ft. The roadway is being constructed in 24 ft. lengths, with felt expansion joints between each bay, while alongside the kerbs a wood feather-edge strip is placed, and afterwards withdrawn, and the space filled with sand and tar. Unwashed beach gravel, mixed with filtered sea water, is being used for the concrete. The surface of the carriageway is afterwards treated with distilled tar and beach grit, which gives quite a pleasing finish. It is anticipated that the council's section of the parade will be completed in the course of a few months.

On Saturday last members of the South-western District of the Institution of Municipal and County Engineers visited Exmouth for the purpose of inspecting the works above described, those present including Messrs. James Paton (Plymouth), district chairman, T. Moulding (Exeter), C. K. Henderson (Pewsey Rural), C. D. Bell (Camborne Urban), A. J. Mildon (Tiverton Rural), J. Siddalls (Tiverton), R. M. Stone (Devon County), G. Saunders (Tiverton), A. Woodgates (Tiverton), Owen Baines (Paignton), G. Paraford (Exmouth), R. A. Rogers (Newton Abbot Rural), C. D. White (Newton Abbot Urban), F. J. Harris (Bideford), C. R. Cole (Somerset County), R. H. Wymond (Exeter), J. Bennett (Exeter), W. P. Robinson (Devon County),

F. E. Simpson (Heavitree Urban), S. Hutton (Exmouth), E. Parr (Bridgwater), W. E. Dean (Exmouth), J. T. Pierce, J. Moore and H. Baines, and D. Edwards (Taunton), hon. district secretary.

Assembling at the council offices, the visitors were accorded a hearty welcome to the town by Councillor Kemp, chairman of the urban district council, and by Councillor Crews, chairman of the Roads Committee. The subsequent inspection, which was favoured by delightful weather, proved of the greatest interest, work being actually in progress when the members arrived on the scene. Tea was afterwards provided at the Undercliff Tennis Pavilion by Councillors Kemp and Crews, Mrs. Kemp, who presided over the arrangements, having the assistance of Mrs. Paton, Miss Crews, Miss Tatcham and Mrs. Hutton.

In returning thanks on behalf of the members, Mr. Paton remarked that a most enjoyable afternoon had been spent in examining the work upon which Mr. Hutton was engaged, and they were greatly indebted to the latter for having arranged the meeting. It was an extensive scheme for a town of the size of Exmouth to embark upon, and they were very fortunate in having had an opportunity of seeing such a work while it was in progress. In that connection their thanks were due to the contractors, Messrs. P. Wilson and Company. The data and costs which would be available when it was completed would be most valuable.

In returning thanks, Mr. Hutton said that, in view of existing conditions, he regarded the large attendance that day as a great compliment, and he realised that it must have been only with considerable difficulty that many had been able to be present.

We understand that when the whole scheme is finished it is the intention of Mr. Hutton to prepare a paper, giving full details of the cost of the works visited last Saturday, and an account of the many interesting problems which have arisen during their progress.

THE POSITION OF TEMPORARY ASSISTANTS.

LONDON COUNTY COUNCIL COMMITTEE'S RECOMMENDATIONS.

The Establishment Committee of the London County Council, in a recent report, state that they have had under consideration the question of the position on retirement of temporary assistants. "The approximate permanence of a large bulk of the council's work can," the committee observe, "be gauged with accuracy, and can be met by the appointment of permanent and unestablished staff in appropriate proportions, but there constantly appears and disappears a considerable quantity of work of varying character, the needs of which can best be met by the employment in a purely temporary capacity of staff as to whom freedom of engagement and discharge is quite unrestricted. In the organisation of a large staff the usefulness of temporary as distinguished from permanent and 'unestablished' staff lies chiefly in the means which it affords for dealing, without delay or extravagance, with this fluctuating work, and it appears probable that the exigencies of the council's work will in the future, even more than in the past, render desirable the existence of temporary staff. In nearly every class of temporary assistants there are men who have been employed continuously for considerable periods, and we have therefore directed our attention to the questions—(1) whether it is desirable that such a state of affairs should continue, and (2) if not, (*a*) what action should be taken as regards men who already have had long service, and (*b*) what steps should be taken to prevent its recurrence."

As regards the first question, the committee are strongly of opinion that, apart from those classes of temporary assistants who are appointed under special schemes—*i.e.*, tramways and stores departments—and those assistants who are classed or are to be classed "unestablished," temporary assistants should not be allowed to continue in the council's service for such a period as to lead them either to think that they will be employed indefinitely or to expect any special treatment on retirement.

The question of the action to be taken as regards temporary assistants who have already had long service presents some difficulty. The main distinction between the permanent and temporary staff has hitherto been the requirement that the former shall contribute to the superannuation and provident fund, and the committee consider it desirable on all grounds that this distinction should be maintained. They think that the case of men who have had fifteen or more years' continuous service, and who are fifty or more years of age, should be distinguished from other cases, and that the council might reasonably agree to extend the operation of the principle already approved of retaining certain assistants after they have attained the age of sixty five years by deciding that such temporary assistants *shall* be retained, where practicable, from year to year after attaining the age of sixty-five years, and they submit a recommendation to give effect to this proposal so far as temporary assistants, eleven in number, under their direction are concerned. The assistants so retained would not necessarily continue to be employed in the department in which they were serving at the time of their attaining the age of sixty-five years, and their retention, which, as indicated above, would be from year to year, would of course be dependent on the need for assistants and the existence of authority for the employment of such assistants. In some cases this might result in the rate of pay of an assistant after retention being less than the rate previously received. Their retention after attaining the age of sixty-five years would also, of course, be subject, as at present, to the committee being satisfied that they are capable of performing efficiently the duties assigned to them.

As regards the remaining temporary assistants under their direction, the committee have approved proposals as follows: (1) That a strict limitation shall be placed upon both the continuous and the aggregate period during which a particular assistant may be temporarily employed; and (2) that the number of temporary assistants employed shall be reviewed as far as possible at the same time as the annual review of the fixed staff.

BRANSTON RURAL COUNCILLORS AND THE SURVEYORS.

The War Office, through a Divisional Officer, asked the surveyor of the Branston, Lincs, Rural District Council, Mr. T. R. Howitt, to undertake the duties of clerk of the works in connection with certain new works pending in the district. The council were recommended to pay Mr. Howitt £46 5s. per annum, the difference between his Army pay and his present salary. When the matter came before the council recently the surveyor, answering the chairman (the Rev. R. E. G. Cole), said he commenced this work on the previous Monday. He thought he had the routine of it now, and there would be ample time to devote to council duties. He could not see that there would be any difficulty whatever.

Mr. W. G. Marshall: A very good arrangement. I was only thinking it would be too economical for the War Office.

Mr. W. Bartholomew thought the district surveyors could have liberated Mr. Howitt and done the work themselves. They had very little to do at the present time.

Mr. Marshall spoke in similar strain.

Mr. J. W. Watson, one of the district surveyors, said he must protest against the remarks of Mr. Marshall. He (Mr. Watson) had never worked as hard as he was doing now. He did a great deal of work, and work for nothing, that many people had little idea of. He had done his duty right along.

Mr. Marshall said he noticed that for one month Mr. Watson had paid in the noble sum of £21 13s.

Mr. Watson said a surveyor's work did not rest with that. He had had to go over every yard of road more than if he had twenty or thirty men working for him.

Mr. S. Horton moved that the £46 5s. be paid, subject to revision if necessary, and proceeded to refer to the work done by Mr. Howitt.

Mr. Howitt said from the remarks made by Mr. Bartholomew now and for several months past it was very evident he knew nothing about his (Mr. Howitt's) work. He could not undertake the whole of the work of the council while working for the War Office. He could look after cases of infectious disease, very urgent work, the Boultham sewage scheme, and so on. It would be an impossibility to look after the whole of the work.

Mr. Bartholomew said he still maintained that Mr. Howitt had a far better job than had most surveyors. He had a very good job. If he could get a better he would be gone to-morrow.

Mr. Horton's motion was eventually adopted.

Nine Years' Work at Sheringham, Norfolk.*

By F. HALL SMITH, F.A.S.I., Surveyor to the Urban District Council.

Sheringham as a watering-place dates back twenty years, but previously the fishing village had a fair share of visitors who came for quiet and the bracing air. The growth of the town is due to the enterprise of the Squires of Sheringham and Beeston and local builders. There are no works of very great magnitude, but 100 yds. of sea wall requires as much thought and care as 1,000 yds. . . . The district was made an urban district in 1902, previously being under the Erpingham Rural District Council.

GENERAL AND VITAL STATISTICS.

Area, 887 acres, excluding foreshore. 1901 -population, 2,359; houses, 713; rateable value, £15,841. 1911—population, 3,376; houses 1,000; rateable value, £22,997.

The census is taken when the large houses are unoccupied, and the estimated season population is 10,000 to 12,000.

In 1915 the rateable value was £25,434, but owing to the war this has been reduced to £21,386, and will be readjusted when times are normal on the East Coast.

This is a remarkably healthy district, and the average death-rate at all ages for the last fourteen years is 10·94 per 1,000, ranging from 7·83 in 1913 to 14·4 in 1906.

GAS AND WATER SUPPLY.

Gas and water are supplied by the Sheringham Gas and Water Company. The lamps, &c., are the property of the council, who pay the company for gas consumed, lighting and maintenance.

SEWERS.

The whole of the sewers are of stoneware socketed pipes, varying from 6 in. to 12 in., and are well laid; total length about 12 miles.

The outfall is 12-in. cast iron, socketed above high-water mark, and flanged below. This discharges 1,000 ft. from the sea wall, and has been lengthened since 1907 336 ft., to well below low-water level of spring tides.

In 1901 the rural district council constructed a septic tank, which exploded in 1903, and the chambers were filled in and covered over. In summer the sewage is screened, ⅝-in. and ¾-in. mesh screens being fixed, and the solids are carted away at night.

In 1914 a 6-in. sewer was completed to connect Beeston Common estate with the main system, for which the prices were as follows:—

Excavation to 6 ft. = 1s. 6d. per cubic yard; 6 ft.-9 ft. = 2s. Very poor prices for wet, clayey soil.

775 lin. yds. 6-in. pipe (cost 1s. 3d. at station) = 3s.

Manholes, £1 per foot in depth, size 4 ft. 6 in. by 2 ft. 6 in. clear.

Square covers, 1 ft. 10 in. by 1 ft. 10 in. = 45s. each.

The author prefers square covers, as entry to manholes is much easier and not so dirty as in the case of round covers. No gullies were fixed, as a stream runs alongside whole length. Total cost, £401 8s. 2d.

In 1914 sanction was obtained for a loan of £900 for a surface-water sewer for portion of town north of railway, between and including Church-street and High-street and Beeston-road, but the work has not been carried out yet.

Prices.—Excavation to 6 ft. deep, 3s. per cubic yard.

304 lin. yds. 6-in. pipe ...	cost 1s. 3d. ...	3s. 0d.
654 lin. yds. 6-in. pipe ...	cost 2s. 6d. ...	4s. 6d.
266 lin. yds. 12-in pipe ...	cost 4s. 1½d. ...	6s. 6d.

Gullies, £6 each connected.

Manholes, £1 per foot in depth.

Make good tar-macadam roadways, 2s. per super. yard.

The sewers are ventilated by means of vent shafts 30 ft. to 40 ft. high, according to surroundings; but there is by no means sufficient ventilation yet—when making up new roads the author includes vent shafts in the work.

HIGHWAYS AND FOOTWAYS.

The total length repairable by the council is 10 miles. The county council repair and scavenge the county roads, which is a very unsatisfactory state of affairs.

The greater portion of the streets have been made up during the last fifteen years; they are sewered by the landowners before houses are erected.

Specification of Roadways.—3-in. by 12-in. patent stone kerbs and channels, 3s. per yard, laid on concrete bed 3 in. thick. Whole flint foundation 5 in. thick, and broken flint topping 4 in. thick, with marl and gravel binding = 2s. 4d. per super. yard. Gullies and vent shafts.

Paths.—2½-in. tar paving on 3-in. foundation in the town, and 2½-in. gravel on 3-in. foundation outside the town. The author introduced concrete in situ for paths, owing to less cost of repairs and probable shortage of tar = 2 in. thick of 6 to 1 concrete, finished with ¼-in. granite chippings and cement, 6 to 1. This cost 2s. 3d. per super. yard, which was the same price as tar-macadam.

The roadways wear from six to ten years, and when repaired are scarified, levelled, rolled, and covered with sufficient 2½-in. tar-macadam to cover the surface when rolled, grouted with tar and spread with a good thickness of gravel, the excess of which is swept off when it has worked in. This makes a splendid surface, and only requires tarring every three years.

One ton of tar-macadam covers 12 to 14 super. yds., and cost was 1s. 6d. to 1s. 8d. per super. yard, when tar-macadam cost 14s. 9d. at station, and gravel 2s. 6d. on site.

Back passages are made up with 3-in. by 9-in. patent stone kerbs, and 4-in. tar-macadam on 4-in. whole-flint foundation.

Loans are obtained for the amount of the cost of making up roads, which the frontagers do not pay when the final apportionment notice is sent; the frontagers are allowed to pay in half-yearly instalments for seven years, adding 4 per cent interest, which is a great convenience to small owners.

Owing to the unsatisfactory way in which the gas and water company repaired their trenches, it was agreed to take over the trenches when filled in and repair the surfaces at the following prices: Tar-macadam, 2s.; granite, 1s. 6d.; flint, 1s. per super. yard.

BY-LAWS.

The building by-laws were the old Model Series of the Local Government Board, but two years ago they were revised and added to as follows:—

Reinforced-concrete walls exempt from thickness required for brickwork, but must have strength necessary to secure stability.

External walls may be 4½ in. less in thickness if built in cement, and cross walls 4½ in. less than external walls, but in no case less than 9 in. thick.

Walls of outbuilding not used for human habitation, not more than 8 ft. high and 10 ft. long, may be 4½ in. thick if built with cement mortar.

Floor boards may be laid direct on to concrete and nailed.

Outside water-closet to be provided, with opening for light and ventilation (window not necessary), and must have supply of water.

Movable ashbins to be provided of galvanised iron with covers.

Surface water from roof to be carried off by eaves gutters and down-pipes.

Height of rooms 8 ft. at least if not in roof; if in roof, 7 ft. 6 in. for two-thirds floor area, and in no part less than 4 ft.

DEPOT AND STOREYARD.

In 1908 ½ acre of land was purchased for £175, on which were erected sheds for vans and carts, tar-macadam shed, joiner's shop, general store, cement store, and fire station, at a cost of £600.

The author has since erected a 2,000-gallon tar tank with ½-in. round indented bars, floor 6-in. thick, walls 5 in., top 4 in., at a cost of £19 18s. 6d. The bars cost £6, cement 27s. per ton, granite chippings 11s., and sharp sand 1s. 6d. per load.

PROMENADE AND PROTECTION WORK.

The total length of sea-board is 1½ miles, the promenade and sea wall extending ¾ mile, protected

* From a paper presented at the Eastern Sub-District (Norfolk, Suffolk, and Cambridge) meeting of the Institution of Municipal and County Engineers at Sheringham on Saturday last.

by eleven groynes, six of which are the property of the council and five of the lord of the manor. The average erosion on this coast is 1 yd. per year.

The original sea wall and promenade were constructed in 1899-1900, at a cost of £19,950, a section is given in Fig. 1.

The cliffs consist of clayey sand, which when wet turns to thick mud, over blue clay, over marl, which comprises the sea bed.

In 1909 the wall was lengthened 113 yds. eastward to the east groyne, as the sea was getting behind the old wall. This was carried out by direct labour, at a total cost of £1,155. The sea wall, promenade and retaining wall cost about £9 per lineal yard, including excavation, cement costing 30s., and gravel and stone 3s. per load. For section see Fig. 2.

At the same time the east groyne was lengthened 250 ft. to below low-water mark, at a cost of £200, with 6-in. by 6-in. piles every 8 ft. and 3-in. by 12-in. planking. Piles driven 6 ft.

The author's experience of case groynes is that from slipping by struts from the back of the original promenade to the back of footings of the retaining walls. These struts are 18 in. wide and 8 ft. apart, of 8 to 1 concrete. Beach stones were used for this contract, and sufficient sand was found in the cliffs.

Cost of shelter, £284 17s. 6d.

Cost of wall and promenade, 115 lin. yds., £765 2s. 6d., including four flights of approach steps.

Compare cost of this shelter with the one constructed with reinforced concrete, and which is the same size exactly.

With respect to loans for protection work, the following are amounts of repayments:

1902-3. Principal, £366; interest, £638; rate, 1s. 1d. 1908-9. Principal, £649; interest, £625; rate, 1s. 1d. 1915-16. Principal, £665; interest, £578; rate, 1s. 3d. on reduced assessment, and 1s. if assessment had not been reduced.

It will be seen that this is a great tax on a small, growing place, and the author certainly thinks that

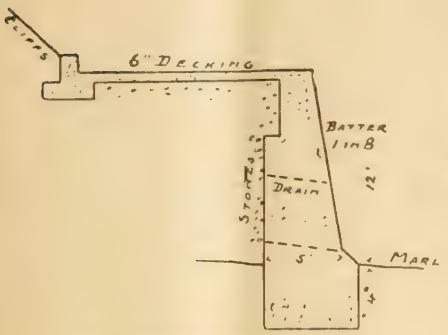

Fig. 1.—Original Wall and Promenade

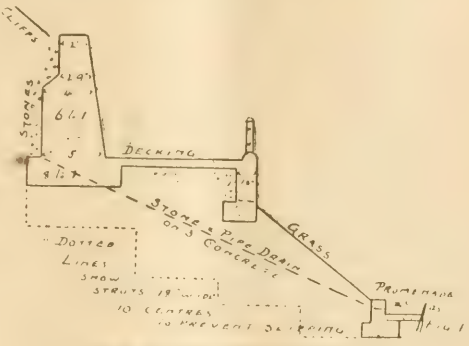

Fig. 3.—Wall and Raised Promenade, 1913.

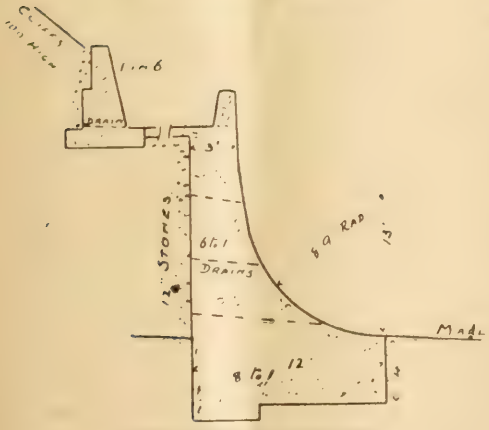

Fig. 2.—Walls, &c., Erected 1908.

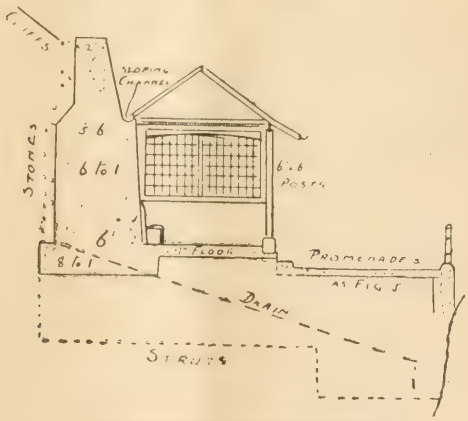

Fig. 4.—Shelter and Raised Promenade.

Sheringham Sea Wall and Promenade.

the beach is washed away round the shore end, so in 1908 he extended both to the sea wall with 6-in. by 6-in. piles, driven 6 ft., and 3-in. by 9-in. sheet piles, driven 4 ft. and standing 6 ft. above beach level, at a cost of £1 per lineal foot of groyne.

A shelter was erected in 1911 by direct labour—floor space 54 ft. by 10 ft.; back wall, partition, and end walls, and floor 6 in. thick, reinforced with ⅜-in. round indented bars. Total cost, including seats, retaining wall in front (not reinforced), and seats in front, £140.

Owing to the great rainstorm of August 25 and 26, 1912, which caused so much damage in Norfolk, and in which Sheringham had 5½ in. of rain, the lower portion of cliffs at the west promenade were washed on to the beach. Instead of filling up again with soil, the author recommended the construction of a raised promenade and shelter. This work was carried out by a contractor, and sections are given in Figs. 3 and 4. The elevation and size of shelter are similar to the previous one, and the whole of the work is prevented

the Government ought to pay for protecting the coast, or at least advance the money, as repayment of interest on loans is more than the repayment of principal. It is argued that the value of land saved is not worth the cost, but land once lost cannot be regained, and it is of national importance that Great Britain should not be allowed to become smaller. Many small places could afford to repay part or the whole of the principal, but cannot afford the added burden of interest, and work for protection only need not be on such a large or elaborate scale as is usual in seaside resorts. At any rate the Government ought to bear some of the cost.

General and Conclusion.

The whole of the works enumerated have been carried out by the author between the years 1907-14. Since 1914 the staff has been reduced and the town is just kept clean. Street watering has not been discontinued, as the council think that it is not advisable to sacrifice the health of the district for the sake of saving a penny rate.

Institution of Municipal and County Engineers.

EASTERN SUB-DISTRICT MEETING AT SHERINGHAM.

A meeting of the Eastern Sub-District of the Institution of Municipal and County Engineers, which comprises the counties of Norfolk Suffolk and Cambridgeshire, was held on Saturday last at the Council Offices, Sheringham. Mr. Arthur E. Collins (Norwich) was in the chair, and others present were: Messrs. F. Hall Smith (Sheringham), L. Keyworth Kerridge (Swaffham), R. Croome (Cromer), F. L. Burch (Dereham), W. A. Lavender (Swaffham), Chas. L. Hamby (Beccles), Henry Miller (East Suffolk), L. Leeper (Great Yarmouth), H. Read (Harwich), and J. R. Mead (Ipswich), hon. secretary of the sub-district.

Mr. H. R. Johnson, chairman of the Sheringham Urban District Council, extended to the members a hearty welcome to the town. Their profession, he said, played a very important part in the local government of the country, and as time went on it was destined to play an even more important part, when such questions as town planning and housing accommodation came to be dealt with more fully. One of the greatest problems Sheringham had had to face had been that of protection from sea encroachment—when he became a member of that council twelve years ago they regarded it as the bugbear of their lives. They were faced with a very serious position indeed, but by the hard work and devotion of capable men of their profession they had got over that difficulty to-day. In former days they lost on this part of the coast an average of about a yard a year through the encroachment of the sea. There was still room for improvement at the east end of the town, but so far as the major portion of the front was concerned, he thought they had got over their difficulty. Mr. Johnson proceeded to refer to the natural attractions that Sheringham had to offer, and particularly the beauty of the inland wooded scenery in the immediate vicinity.

Mr. Collins, on behalf of those present, returned thanks for so hearty a welcome, and said they were very pleased to have an opportunity to come to Sheringham for a meeting. A growing and "live" place such as Sheringham was the type of town where they could get very valuable experience, and that was the reason why they came. He had known Sheringham slightly for twenty-two years, and the development which it had made in that period was extraordinary. It spoke volumes for the enterprise of Sheringham people.

The business of the meeting was then commenced and the chairman at the outset made an appeal on behalf of the Orphan Fund, for which he said funds were badly needed.

Mr. F. Hall Smith, the surveyor to the urban district council, presented a paper on "Nine Years' Work at Sheringham"—reproduced elsewhere in this issue.

SEA DEFENCE.

The hon. secretary said some interesting letters commenting on the paper had been received from members who were unable to be present.

Mr. H. Clegg (Felixstowe) wrote: The question of sea defence is one of paramount importance to dwellers on the East Coast. The vagaries of the North Sea cause, perhaps, more erosion on the East Coast than on any other coast of Great Britain. I am of opinion, formed after several years of experience, that sea defence work cannot be generalised. A system which is admirable in every respect as a protection to a given length of coast line may, if applied to another length of coast line, be its undoing. Therefore, anyone with a universal panacea by whomsoever employed should, to my mind, be avoided, excepting perhaps as a consultant. A brief consideration will, I hope, bear out what I say. Sea defence works must be designed according to the geographical, geological and maritime conditions. Erosion invariably takes place at high water. When a north-westerly wind is prevalent over Great Britain it drives an abnormal amount of water from the Atlantic into the North Sea, round the north coast of Scotland. This condition, prevailing simultaneously with spring tides, has often disastrous results, especially if the north-westerly wind has a tendency to veer. Fortunately, the sea is never very rough during prevalent north westerly winds. A glance at the map will show that the elongated sand banks parallel to the mainland form a sort of double outlet to the English Channel, and to coast lines lying approximately north-east this condition is an additional adversity. The geological formation of the coast must have a great bearing upon the extent of erosion during high tides; an indurated formation is obviously better able to resist the attacks of the sea than alluvial formations of comparatively recent geological age. When the sea is shallow for a considerable distance from the coast, the erosion of foreshore or destruction of coast defence works is not so disastrous as when there is deep water contiguous to the coast. Deep water is necessary to float large waves, which obviously are more destructive than the smaller waves of the shallows. There are many other considerations, but the foregoing are perhaps sufficient to show that local knowledge is essential to successful sea defence work. Indeed it is, I consider, impossible for an engineer to hope for success without an intimate knowledge of local conditions. The bringing in of a stranger to construct defences on stereotyped lines is as futile as it is absurd. A consideration touching nationalisation, perhaps, should not be overlooked, and that is that seaside places which have spent large sums of money on their sea defence work should not at any time be called upon to pay for work in districts where no protective measures have been attempted; also it would be highly inequitable to utilise money from poor agricultural districts to help comparatively wealthy seaside resorts in their expenditure on defence schemes. It seems to me that every portion of coast worth protecting must work out its own salvation, and Government grants to localities requiring assistance would, I think, be a better and cheaper solution than nationalisation.

Mr. J. S. Hurst (Southwold) wrote: I am quite in agreement with Mr. Hall Smith's views that the Government should pay some proportion of the cost of the necessary work. There is no question but what the construction of defence works is a matter of national concern. This erosion is far more serious than many imagine. Take the Holderness coast of Yorkshire—from Flamborough Head to the Humber—then take the coast in the vicinity of Southwold; the erosion at both these places averages about 11 ft. per annum, which means one and a third acre per annum per mile of coast. This erosion of course does not take place where protection works have been carried out in the front of the different towns, but along the unprotected coast line, and where this occurs nothing is done, as the owners cannot afford to protect land when the cost is more than the land is worth, and this is where a helping hand is needed. Southwold, like Sheringham, has had to pay for its safety. £23,500 has been sunk up to the present (considerably more than the rateable value of the town) in fighting the sea, this amount not including any elaborate promenades, but being simply for necessary works. The corporation have the consolation, however, of knowing that up to the present the fight has been waged successfully. Surely, in face of these facts and the courageous way in which the smaller towns have struggled, it is not asking too much when one mentions the words "Government grant in aid." Some few years ago a Commission on this subject was appointed, the coast inspected and full particulars obtained of the erosion in different parts of the country, but nothing has been done. With regard to the construction of groynes, my experience teaches me that the best type of groyne for this part of the coast is long, low, timber-planked or sheeted groyne extending well below low-water mark. I have found these to answer much better, both here and on the Yorkshire coast, than high groynes.

Mr. Hamby pleaded for more unity in sea defence schemes between one council and another. At Sheringham, for instance if they put out a system of groynes for their own protection they caused the scouring of the coast to the eastward. It was the same at Lowestoft; protection works there caused damage at Pakefield, and heavy burdens placed on a rural district council that could not afford to bear it.

Mr. Leeper pointed out that a great deal of land was reclaimed yearly from the sea more, in fact, than was lost by it.

The Chairman. What is the value of such land? Except to such places as Yarmouth it is practically worthless.

Mr. Croome said that coast erosion was a serious matter for this part of the coast. Recently he had the opportunity of comparing an old map of Cromer, dated 1747, with the Ordnance Survey of 1885, and he found that during this interval of 138 years the land lost on the west boundary was 160 yards and on the east boundary 107 yards. This erosion had stopped during recent years, except at the boundaries, the front of the town having practically lost nothing. They were now suffering most on the eastern side. Cromer had now excellent shore protection, but it required extension to the east. Cromer had put in large groynes and good walls; he considered these groynes were far too light. The difficulties of the present position of shore protection were that small authorities had no obligation to protect, no means and no power. Work in one district under present conditions might cause considerable injury to an adjoining district. If the Government granted loans on the lines of those granted by the Road Board, great help would be afforded; but in face of the fact that it had cost Belgium £2,000,000 to protect only some fifty miles of coastline, it was useless to expect our Government to take over the cost of protection of our extensive coastline.

On the motion of Mr. Croome, hearty thanks were accorded Mr. Hall Smith for his paper and hospitality. A similar compliment was paid the chairman and the hon. secretary.

During the day the members had lunch at the Sheringham Hotel, and were entertained to tea by Mr. Hall Smith.

ANNUAL GENERAL MEETING AT BLACKPOOL.—(*Conclusion.*)

With this instalment of our account of the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool we conclude the report of the discussions of papers. As will be remembered, time did not permit of the consideration of the whole of the papers prepared in connection with the gathering, and these will be reproduced as opportunity offers. In moving discussion on the paper entitled

THE DESTRUCTION OF A MACADAM ROAD,

by Mr. T. W. Arnall, Assoc.M.Inst.C.E., of the city engineer and surveyor's office, Birmingham, the president (Mr. J. S. Brodie) described the contribution as one of the finest on road construction it had ever been his lot to read.

The paper in question was reproduced in The Surveyor of last week.

Mr. C. H. Cooper (Wimbledon) said he did not think they had ever had a better paper on this subject, although he might be allowed to differ from the author on several points. As regarded waterbound macadam, Mr. Arnall seemed to advocate it and at the same time to point out the absurdity of attempting it. Where they had got stones of different sizes it was utterly impossible to get those stones into position so as to have all the voids filled up. The only thing they could do was to get the various sized stones as they were required to build up a road foundation. Large stones might be very well in the bottom, but he had noticed for many years the tendency of large stones to get to the surface. There was one thing stated which he could not accept—that large stones got their corners knocked off at the bottom of a road. He agreed that where they got wave action that might take place. He had had some trouble with a tar-macadam road, and in that case he was getting some trial holes open, and they found the ordinary London stock brick, 10 in. under the surface, and the corners had not been knocked off. Now, that was a very soft material when compared with the stone used in London, and they would think the traffic would be very capable of knocking off those corners. As regarded what Mr. Arnall said as to the effect of wet on the roads, there could be no doubt about its ill effect on the road. They had only to go along a road on an autumn day. If the day was not too wet or too dry they could see the places where the bicycles went. It would be all right if they could get a certain amount of moisture in the road. He had a waterbound macadam road which had stood 'bus traffic perfectly. They laid a road down in spring or autumn, when the weather was often very wet. The coarse material was taken away for about 4 in. to put down a tar-macadam top, and below that was the ordinary gravel, which contained a good deal of binding material and a good deal of clay. It stood perfectly well as a road before, but the wet had got into it, and it was extraordinary how it held up the wet. The great destroyer of the roads now was wet. He had been rather surprised that in the paper the author had not alluded to wave action, because that was an absolutely destructive force to the roads. A road might be able to carry the weight which was brought on it just as a bridge was able to carry the weight brought on it. But so soon as they had wave action there was no doubt that was the great destructive force. If a road was to carry traffic economically, they must treat it in exactly the same way as they treated the bearings in the case of machinery they must keep it as smooth as possible. They had great advantages in keeping the road smooth, one was that they were able to maintain it more economically, and, further, it was able to carry more traffic. The idea of allowing roads to get into their present state was the most ridiculous thing possible, because it was like throwing hundreds of thousands of pounds away, and economising in a few thousands of pounds, the spending of which would produce great economy in the use of the roads.

Mr. A. E. Collins (Norwich) referred to the question of the sizes of wheels, and the way the effect of the allowable weight varied with diameter. He quite agreed that the rules of the Board of Trade were reasonable as to weights with vehicles of moderate sized wheels; but when they came to wheels of considerable diameter he did not think the rule should hold good. They all knew that with the use of vehicles with wide tyres those tyres would not bear weight equally over their whole width. What was wanted was some means of equalising the pressure through the whole width of wide wheels. He knew it was a complicated question. He had been trying to work out a machine for doing it. Unfortunately, the makers of vehicles did not want to do it, because they wanted to sell their vehicles; but engineers wanted users to allow their roads to have a chance, and they did not stand a chance if too wide widths of wheels came on the roads.

Mr. O. E. Winter (Hampstead) said in this paper they had stated afresh in a way that only a scientific mind could the old-fashioned objections to macadam roads. The paper should be a knock-out blow to the old-fashioned macadam road. They were utterly sick of it. The less they had to do with water-bound macadam roads the better it would be for their councils and for those who used the roads. There was no doubt that water was insufficient to bind roads. With the motor-omnibus traffic, the water-bound macadam road was utterly out of the question. They were trying to do their best with tarred surfaces and with bituminous materials to get a nice even surface. His recent experiments during the last two or three years with a bituminous carpet on an adequate foundation was one of the best ways of sustaining the traffic, and at the same time the most economical. That had been their experience in Hampstead. His road costs were going down, because for the last seven or eight years he had adopted a bituminous construction.

Mr. W. Harpur (Cardiff) remarked that Mr. Cooper had mentioned that Mr. Arnall did not refer to the effect of wave movement in the road surface. As he read the paper, he thought Mr. Arnall did most clearly refer to it. He said: "That there is such a sideways tendency to escape is well seen in a pulpy road; the rut formed by a heavy-loaded wheel is plainly due to a lifting at the sides as well as to a sinking under the wheel. Often it may be seen in front of a roller at work on a thick coating; the mass rises as a flat wave in front to be forced down again as the roller moves over it. In any case there is no salvation, whether the view of one big crack is taken or a multitude of small ones; whichever view is taken the destruction of the material goes on just the same." He was afraid Mr. Cooper had not read the paper very carefully.

Mr. H. E. Stilgoe (Birmingham) remarked when he approached Mr. Arnall the latter said he would prefer to write upon the destruction of roads rather

than the construction of roads. He thought it was greatly to their benefit that Mr. Arnall had done so, because he had put the case so very clearly before them that the information given was of the very greatest value. He could not understand anyone considering for a moment that the internal wear upon a road was a small matter. He happened the other day to read an original contribution, which was written in 1821, by the late Mr. Loudon M'Adam, and he began that report upon the old roads of London with the statement that the gravel of which so many London roads were made at that time was unsuitable on account of its roundness. If there was, he said, no interstitial wear, or internal wear, there would be no objection to using the round stone in the course immediately below the wearing surface. They all knew that those roads which had for the upper part of their foundation, immediately below the wearing surface, material composed of rounded stones, were always in trouble. Those stones were really never at rest, because of the influence exerted by the pressure transmitted through the wheel to the internal portion of the road. As Mr. Arnall very ably illustrated it by the cone, one expected naturally that that disturbing influence was decreased according to depth. Mr. Cooper had mentioned an instance in the road he opened of a London stock brick 10 in. below the surface with the edges practically as they were when put into the road. That might very well be; there might be reasons for that, and it was a very fair depth below the surface. But they knew in opening the road for repairs, for trenches, and for making renewals, they did find this very great internal wear upon the stone. They must have some other means of binding the stone, and holding it firmly in its grip to keep it up to its work. With a granite sett they held that up firmly to its work as a tool was held firm to a grindstone. If they put a tool to a grindstone with a wobbly hand they got no result, and he thought this applied to roads. These points were not always appreciated. Mr. Arnall had mentioned another important matter, the great quantity of clay in road surfaces, with many stones employed in road making. He knew stone which, wash it as they please, and break it with a hammer, they found clay on the surface; crush it and test it in the tube and they found clay. That would take days to settle, according to the quantity. The heavier parts, the dust and the fine chippings sank to the bottom. He believed clay had a great deal of influence upon this subject. These matters were entirely put upon one side when they took into consideration bituminous bindings. The effect of wetness, which Mr. Arnall had referred to, also pointed in the direction of the greatest care being taken in keeping the surface of the roads solid. The wetness which was observed at potholes would show them that destruction took place there more than at any other part. If they could only keep their surfaces solid and intact they would have arrived at what they were striving for, and he thought the only way to do that was by using a binder of a bituminous nature in the construction of the roads.

Mr. Matthew Jones (Chester), speaking as to remedies, said as they were aware he had constructed some reinforced concrete roads. He had brought the reinforced concrete up to the surface for the traffic to travel over, and he was quite convinced that every road must be bound with some material that was going to keep the granite in its position. He had to keep his roads closed for three weeks or a month, according to the weather conditions, to allow the road to set thoroughly. That was the great drawback at the present time, but there was no doubt that concrete roads would come into use in this country. They stood the wear of traffic very much better than tar-macadam roads. The whole thing was put together as one mass, and so far as he could see there was not the slightest movement whatever. In a tar-macadam road they still got movement, because they had got weather conditions, rain and snow, to contend with. A concrete road became impervious if they allowed it to set properly. If they once got a concrete road set they might take it from him that they had got an excellent road. If they tar-sprayed the surface and spread with granite chippings after it was set, they went still further to make it impervious to weather. There were no potholes in the road which he constructed four years ago. There was no brushing, or very little, required, because when the rain came down it washed the road clean. He had been asked by several members with regard to women's labour at Chester, which was mentioned in the Presidential address, and he would like to say one or two words on that. At Chester they employed women labour in various departments, and on various kinds of work. He had got women doing tar-spraying, and they were doing it exceedingly well, equally well as some of the men he had working on the same class of work. They brushed the roads, they actually did the tar-spraying, and spread the chippings. The only man he had on the job was the man who looked after the tar boilers and the boiling of the tar. He had not been able to get the women into the way of boiling the tar to the right consistency. They had women working on the sweeping of the streets, and they did it exceedingly well. A friend of his spoke to a woman who was brushing the road, and she brushed the sweepings right on to the top of a gully. This was what they had to contend with. His friend said to her: "You should brush round that grid," and she replied: "It is less work, because it goes down." Unfortunately, many of his gullies had been stopped. The surveyor must not expect the same work from a woman as from a man, as they had not got the strength to do it. He was rather surprised to read the other day that the women brushed too heavily and brushed up the macadam. He wrote to a friend and said they brushed the streets as if they were carpets and not macadam, and not hard enough to his liking. He was sure woman labour had come to stay in this country; he had not anything like the trouble with women as with men. They had also women engaged in the collection and stacking of paper, and they were making a very good profit. He tried women on the refuse tip, but he was not able to say he had succeeded there. It was rather dirty work, and not very nice. He had women engaged in the parks cutting the grass with lawn mowers and planting flowers. He could assure them that, so far as Chester was concerned, woman labour had been the salvation of keeping their roads going in very good condition.

Alderman Bainbridge (Stockton-on-Tees) said they had three streets running east and west and three running north and south. They were made of tar-macadam. The streets running east and west had been trenched down and filled in for a depth of 15 or 16 in. with good slag and clinker, properly rolled in, and 5 in. of tarmac on the top. The roads running east and west they had trouble with. The roads running north and south were like the roads in Blackpool—good roads. Their experience had been that the foundation which had been laid under those roads running east and west had been too rigid, and if they got too rigid a foundation they got more pounding upon the tarmac. The traffic seemed to push the tarmac out of place, and they got depressions in the road.

Mr. H. T. Wakelam (Middlesex) said it was not his object to make any remarks upon the paper, but he rose to ask Mr. Matthew Jones for some particulars as to concrete construction. He wanted to know the tonnage per day on these concrete roads; particulars of the aggregate of the concrete and particulars of the other materials.

A Member also asked the number and weight of the mechanically-propelled loads on these roads.

Mr. Matthew Jones replied that the weight of the traffic over these roads was anything from 80 to 120 tons per day.

A Member: What is the width of the road?

Mr. Matthew Jones: The width of the carriageway is 20 ft. The largest weight which had gone over the road at one time was 15 tons.

Mr. Wakelam: A traction load?

Mr. Jones: A traction load on four wheels. Then with regard to another concrete-made road, the Whitefriars-road, he could not say what the weight of the traffic was. It was lighter, but more constant. There would be anything up to 500 vehicles a day passing over it.

Mr. Wakelam: One-horsed vehicles?

Mr. Jones: Yes. The aggregate was mixed five to one. The stone was graded ¾ in. to 1½ in., and that was mixed together.

The President: What kind of stone?

Mr. Jones: Granite. The Whitefriars-road was done with granite from Penmaenmawr.

Mr. S. S. Platt (Rochdale): Was the concrete reinforced? And what is its thickness?

Mr. Jones: 6 in.

Mr. Platt: What sort of reinforcement?

The Surveyor

And Municipal and County Engineer.

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Mr. Jones British reinforcement. The road has a clay bottom.

Mr. Wakelam: What was the cost?

Mr. Jones replied that the cost of the road worked out very cheap. The railway siding was only 300 yds. away from the tip, therefore the carting was very much cheaper. The cost of the cement and stone all had to be taken into consideration. This particular road, he believed, cost 3s. 10d. per yard.

A Member: Is that the Whitefriars-road?

Mr. Jones: No, the Whitefriars-road cost more than that. The Whitefriars-road cost 4s. 8d. per yard, owing to the longer distance of carting and the increase in the price of material.

The President: What is the average price to maintain over a period of four or five years?

Mr. Jones replied that he had never had to touch the road in four years, but once per tar-spraying, and the road was as good to-day as when laid down.

Mr. H. G. F. Gillan (Belfast) said he quite agreed with Mr. Sturge that it was the holding up of the surface of a road to the work that was the main factor in resisting destruction, and the whole question was the best method of doing that. Mr. Stilgoe had dealt with stone in block. In the form of a setted paving it would probably last ten times as long as a stone which was broken and put down in the smaller shapes of ordinary macadam. Then they found the intervening method of closing their voids and sealing with a bituminous binder something like five times the life of ordinary water-bound macadam. That was because the stone was bed to the work. He would like to mention another point which had come to his notice this year. He dared say that other places like Belfast had been restricting street watering. The men had told him that the wear of the roads had been greatly lengthened by not doing any street watering. That was significant. They wanted a binder that would resist street watering. It was a point worth knowing, and people would have an opportunity of considering it. He wanted to add one other question with regard to Mr. Jones's remark, and that was as to the repair of concrete surfaces. The great difficulty with concrete was to bind concrete with concrete. If they found the surface wearing off with a fine lamination they had got to reinstate that. How were they going to do it? That was a point he should like to know something about.

Alderman Harwood (Worcestershire) said he had been a good deal interested in noticing an omission from Mr. Arnall's paper, and also from the speeches of those who had spoken on it. That was the effect of the expulsion of a jet of water from a pothole. He had always imagined, and his observation had confirmed the view, that it had a very destructive effect on the road. The small detritus must be forced out and the pothole increased in size from that action. He thought that was borne out by observing the potholes during a period of fine weather, and then, a month later, after a period of wet weather. Mr. Arnall, in developing his argument on interstitial wear, said the destruction of a macadam road was not a question of wear on the surface. A wheel might pass by and leave no track behind. He admitted a wheel might pass by in fine weather and not leave a track, but he had never found a wheel bearing in wet weather which had not left one. And he thought where that track was, in nearly every case, the edge of the stone had been broken down.

Mr. H. T. Chapman (Kent) said that on the London-Dover road they had a traffic of 1,000 tons per twenty-four hours, varying from traction engines to bicycles. A section of this road they laid with concrete 6 in. in thickness, some portion reinforced, the other portion with plain concrete. Unfortunately they could not close the road during the carrying on of the work. Consequently 1,000 tons of traffic a day was concentrated on 10 ft. of road, while the other portion of the road was made; as a result the heavy traffic caused serious damage to the concrete. After consultation with the Road Board it was decided to carry out the work with 3 to 1 in sections with different kinds of concrete. The section laid with 3 to 1 concrete was as good as when laid, but the 6 to 1 concrete, graded from ¾ in. to 1½ in., was not a success. He did not know the reason why the more rough graded concrete would not stand the compression of exceedingly heavy traffic. It might be that tar-spraying would do something for it, but if Mr. Jones would experiment with a road on which there was some traffic it would not be so successful as in Chester. If a contractor came to him and promised to lay a road he found him the worst possible conditions for experiments. He thought before they laid a material at such an expense per super. yard they should test the material under the most trying conditions. He liked to hear of failures—they were more interesting to him than successes.

Mr. J. Paton (Plymouth) said he thought it would be unreasonable to ask local authorities to make roads in such a way as to stand any kind of traffic. Surely road users had some kind of responsibilities in the kind of tyre used upon their vehicles, and the Legislature should deal with them. He had had forced upon him in Plymouth on the roads the conveyance of coal from the docks to the gasworks. They were using steam lorries for the carrying of the coal. The road was constructed of granite setts on 6 in. of foundation to begin with. The road gave way very soon, and they found the foundation was crushed. They reconstructed that road and put in iron bars and repaved with Penmaenmawr setts. What happened then, with a perfectly rigid foundation, was that a grinding action was going on and the setts were being worn away. He thought it was unreasonable to throw upon the local authority the responsibility of keeping that road in good condition. There ought to be some limit to the load that should come on the road, and some restriction on the kind of tyre used on the wheels.

Mr. Arnall said he was very pleased indeed at the kindly way in which they had received the paper. Mr. Cooper referred to the upward forces as being destructive. Perhaps he should not say that he wilfully left that out, but he did so. It seemed inconsistent with the assumption that they were only dealing with the top surface, and assumed there was a good solid foundation beneath it. If he had taken into effect these upward forces they would have vitiated the underlying assumption and led to a lot of indefinite expressions. He thought it better to confine it to one basis, and thereby leave it much easier to discuss. That was his only reason for leaving that out. He quite agreed with Mr. Collins that the size of wheels and the width of tyres had an effect. But the Board of Trade by-laws had to be of a cast-iron nature, and when they got the wheels beyond a certain width they began to lose the good effect of the width; he would not say they began to lose the effect—they did not get it at all, as they did not have a level surface to travel over. They would not get the effect of the width unless the road was a dead level. If they had a soft tyre they got the weight distributed over a larger surface, but with a rigid tyre they did not. That was one of the sins of the road roller. When they began to roll it might not go on a quarter of the width, so they got the projecting portion of the surface crushed to the general level. If there was a good camber on the road instead of the tyre acting as a roller, they might have the roller acting as a destructive effect and breaking up the road. These remarks about even surfaces met

the remarks of Mr. Winter. An even surface was of very great importance: it stopped the concentration of the load which they must have upon the projecting parts of an uneven surface. They could not have the weight of a portion with the cone he had described, that cone having a tendency to break away from the macadam round it which did not carry the load. That was the principal reason why they got so much interstitial wear. He agreed that potholes were due to the horses' hoofs upon an imperfectly rolled surface. They disturbed the surface; they only got it restored, and that left a weak place in the road. That was the cause of the pothole in the road. When it was once formed a pothole went on in increasing formation. Whatever caused unevenness in the surface must cause local weakness and resulting potholes. The peculiar thing about potholes was that one pothole insured the formation of another, until they got a row of these potholes all having their origin in one place. He agreed with Mr. Stilgoe that a thing of great importance was to keep the surface solid. If they kept the surface solid the water ran off before it got in. They could not get it perfectly solid. If they could get enough moisture in to keep it damp, and yet not allow the wet to get in to the road, it would be better than a dry road. They had one piece of concrete road in Birmingham which had been down about twelve or fifteen years. It had been repaired, and was still in very good order. But it was on a dead level surface, and there was not very much traffic on it. The trouble was that when the surface did begin to wear out they could not repair it with effect. With respect to Alderman Bainbridge's remarks, he should like to get some more knowledge of those roads running east and west and these running north and south. He maintained there was a considerable difference in the wear and not the construction. Mr. Gullan referred to the importance of holding the stone to the work. It was a long time ago when he made a comparison between the wear of the actual amount of stone used on a macadam road as compared with the amount of stone used on a granite-paved road. They had granite-paved roads in Birmingham where the granite had been down for fifty years. They were 6-in. setts, and he did not suppose they had worn ½ in. He supposed if it had been put on in the form of broken stone they would have had to put 3 in. or 4 in. on every year and cart it away in the form of mud. They would have had to put 10 ft. of stone on the road in that time in little pits, and scrape it off as mud. It was enormous the difference between the wear of setts and broken stone. The remark of Mr. Gullan about the beneficial effect of not watering the roads was a very useful one, and ought to have a useful application. He only hoped it could be confirmed. With reference to Mr. Harwood's remarks, he had evidence upon surface wear, but he was not going into that, and wanted to point out that it was unimportant as to what was going on down below. He was not quite able to follow Mr. Chapman's remarks on the London-Dover road, but he understood him to say that the rough concrete would not stand where the finer concrete did. He did not know why that should be. His notion of a concrete body was that it should be perfectly solid, and it should not make much difference whether the stone was large or small so long as the other things were equal. It might be that the larger stone when it began to wear would show isolated points, and the stone would give way. If they crushed the stone which formed part of the solid mass they made a pothole there, and the trouble would extend. That was the difference probably between the rough and the smooth surface. Mr. Paton made remarks about the steam lorries destroying the setts. He gathered that was due to the foundation giving way. They had during the last three or four years the destructive agency by which setts were being crushed, and those setts would not be crushed if the foundation were not as good as it was. It was like putting the sett upon an anvil and giving it a blow with a 10-ton hammer. They had got a good many granite setts crushed in that way. The only thing they could do was to repair the road. They got none of that effect with rubber tyres. That pointed to the fact that rubber tyres were the proper thing, and they ought to do as much as they could to extend their use provided they could have a road surface to suit them.

Sir William White Memorial. £3,000, collected for a memorial to the late Sir William White, will be devoted to a research scholarship fund, a medallion portrait in the Hall of the Institution of Civil Engineers, and a grant to Westminster Hospital.

ACTION AGAINST AN IRISH COUNTY SURVEYOR.

At the Londonderry Assizes, on Friday last, Mr. Justice Gibson and a special jury heard an action brought by three farmers and road contractors—Michael M'Guckin, Derrychrin, Eglish, County Tyrone; James M'Guckin, and John M'Guckin, of Ardagh, County Londonderry, all brothers—against Charles L. Boddie, county surveyor of Londonderry, to recover £500 damages for alleged libel. Defendant pleaded privilege.

The alleged libel was contained in a report made by the defendant to the Magherafelt Rural District Council concerning a road for which the plaintiffs' father had been contractor. After the father's death the plaintiffs continued the work on the road. The report was as follows:—

"I have to report a serious case of fraud in connection with the materials on first-class road No. 26, from Ballyronan to Coagh. The materials were measured by Mr. M'Farlane on September 6th last, and the road contractor was credited with the value of the materials then measured. Since that date there have been stolen from the road 55¼ cub. yds. of metal and 11¼ cub. yds. of stone screenings, the total value being £33 5s. It is impossible to believe that the representatives of the contractor, who, it is said, died recently, were not privy to this act, and therefore I must hold these representatives responsible for the loss of materials and breach of contract. Under the circumstances I don't see my way to certify for any further payment in respect of this contract. Further, the county council may consider it necessary to prosecute the persons concerned. I have pleasure in stating that it is due to the care and vigilance of Mr. M'Farlane that the theft was discovered, and he was ably assisted by Mr. M'Nulty in measuring the materials and checking quantities."

The plaintiffs were examined, and stated that the stones could not have been removed without their knowledge, and no stones had been taken away after the date they had been measured and certified.

Mr. Brennan and Mr. Tipping, surveyors, proved that there was no shortage in the metal which they measured.

Mr. Elliott, chairman, Magherafelt Rural District Council, and Mr. William Hastings, clerk of the council, were also examined.

Mr. Babington (for the defendant) asked his lordship for a direction on the ground of privilege, and that there was no evidence of malice.

His lordship said the occasion was highly privileged. There was not a particle of evidence of malice. It would be a hard thing if these respectable young men should be aspersed in this way if there was no real shortage.

Mr. Babington said his client was quite willing to withdraw any imputation contained in the report.

His lordship directed the jury to find for the defendant, the latter disclaiming any imputation on the honesty of the plaintiffs. His lordship also expressed the opinion that the county council should absolve the plaintiffs from costs and indemnify the county surveyor.

Concrete Drinking Troughs.—Many estate agents and estate clerks of works employ their bricklayers and labourers during slack times in making concrete articles for the farmers on the estate. Drinking troughs for cattle, which were formerly made of wood, are now made with Pudloed cement on the Earl of Dudley's estate. The troughs are 10 ft. by 2 ft. by 18 in. deep, 2½ in. thick at the bottom, diminishing to 1¾ in. at the top of the sides. These troughs are indestructible, and we understand give great satisfaction to the farmers.

Building Regulations.—An inquiry during the week at the Ministry of Munitions regarding the new Order in Council regulating building elicited the information that work which was in progress before July 20th need not be stopped pending the granting of a licence. Any building commenced before that date should be continued until such time as a licence should be definitely refused. There is no desire to restrict building unless a national purpose can be served. The principal purpose of the Ministry is to limit the use of structural steel, a further purpose being to assist the Ministry of Munitions in obtaining such building labour as is urgently required upon munition factories.

Motor Vehicles for Municipal Work.

DISCUSSIONS AT CLEANSING SUPERINTENDENTS' CONFERENCE.

(Conclusion.)

On the presentation, at the recent conference of the Institute of Cleansing Superintendents of papers* by Messrs. W. Greig, Glasgow, and James Bee, Blackpool, dealing respectively with the subject of street cleansing by motors, and street watering with electric vehicles.

Alderman Hornby (Manchester) proposed the customary votes of thanks. In his opinion motive power for street watering and street cleansing was absolutely necessary. In Manchester they had been somewhat backward in this respect, but he hoped the corporation would benefit from the excellent papers read that day.

Mr. L. S. Mackenzie (city engineer of Bristol) seconded. He said the papers were eminently practical and contained a good deal of useful information. At Bristol they were keeping their eyes open. They had not introduced any electric traction yet. He saw the watering machine at Blackpool a few weeks ago, and he was very pleased with the work done by it. As far as road-sweeping was concerned, they had had two Lathy machines in Bristol since last October, and were more than satisfied with the results obtained. He had not got any figures, but he agreed with Mr. Greig that it was no good taking any notice of remarks about doing away with seven, eight, or nine horses with this machine. He kept the cost for three months as compared with three months in the previous year, and there was not the slightest doubt they were effecting a saving of £150 per annum on each machine. The only thing they found with these machines was that they did more sweeping than before they got over the ground so quickly. They were able to get the busy part of the city cleared by nine o'clock.

Councillor Holden (Manchester) asked Mr. Bee by what means he was able to save £50 on the water.

Councillor Blackburn (Leeds) said he could say ditto to almost all Mr. Greig had said. Mr. Greig had said that in Glasgow as nearly as possible they were overtaking the work of three horses. In Leeds one of their

MOTOR SWEEPERS

was taking over the work of three horses. He thought the motor sweeper had a great future in store for it. The difficulty they had at Leeds at the present time in all departments was the shortage of labour. When the war was over, and the difficulty was removed, he thought that in most of the large municipalities there would be a very large fleet of motor sweepers, because they did the work most expeditiously, and working as they did mostly in the night, they could cleanse the town and have it in perfect order for the early morning.

Mr. H. F. Wigfield (Leicester), Bailie Coughtrie (Motherwell), and Mr. R. H. Stoker (Tynemouth) asked for further information on points in the papers.

Councillor Dr. Greenhalgh (Bury) said that some of the large railway companies had taken up electric motors for cartage work, and this in itself was sufficient to cause local authorities to watch developments in this class of traction.

Mr. J. Priestley (Sheffield) said the conference had demonstrated that they had some very good readers of papers. He wished Mr. Greig to clear up one or two points. The first was whether the sweeping of the streets in Glasgow was carried on during the day or night, or both. If it was carried out both day and night, did we use the motor sweepers on both shifts? and if not, why not? because if the machine would do the work of rather more than three horses on one shift it would do the work of double the number on two shifts. Mr. Greig had also dwelt on the

MOBILITY OF THE HORSE

and used the argument that a horse was more valuable in one respect than a motor, in short, it could be transferred from one class of work to another, and he instanced the transference of the horse from the removal of house refuse to the clearing of snow. He wished to know if Mr. Greig had had experience as to the efficiency or desirability of using motor sweepers during the early parts of a snowstorm in perambulating the streets and preventing the accumulation of snow. He believed that in some districts that plan had been used with good results. Turning to Mr. Bee's paper, Mr. Priestley said it was stated that the vehicle, during the dinner hour, was given a boosting charge of about 1½ to 2 hours' duration. Did he mean that the vehicle was boosted for that period, or merely that it was charged at normal rates for 1½ to 2 hours? Mr. Bee also said that his figures were based on 1½ units per mile. Was that the result of actual experience, or merely an estimate? Mr. Priestley asked Mr. Bee for further information with regard to the saving of £95 7s. 2d. in two months in comparison with the previous year. Before the figures could be of any value they ought to know the climatic conditions for the two periods. Mr. Bee did not say, too, whether the mileage of the streets was identical in both cases. Mr. Bee had mentioned for depreciation on the batteries for a period of two months a sum of 8s. He (Mr. Priestley) wished to know what was the guarantee that accompanied the battery, because he understood the guarantee usually given with this class of battery was limited to two years' use. If 8s was the rate of depreciation for a period of two months, or £96 for the two years, that seemed not to be anything like sufficient, because it did not provide a sufficient sum for the renewal of the battery at the end of the guaranteed period. He also wished to know why Mr. Bee had made no allowance in his estimate of cost for the maintenance of the vehicle.

Councillor Stephens (Bristol) said he had come to the conclusion that horses could not be entirely replaced by mechanical power. Everything was against the horse to-day—the price and the cost of provender, which was almost double. In his opinion, when the war was over they would go back to the horse, which we always thought so much of in this country.

Councillor Broadbent (Oldham) said that Mr. Greig had not said anything about taking up the refuse after the sweeper had done its work. He would like Mr. Greig to tell them the difference in the picking up of the refuse by motor sweeper and by horse sweeper, and show a comparison as to how many men followed the machines.

Bailie R. Mitchell (Glasgow) said that Mr. Greig had been a strong advocate for the work of the horse, but he had been public-spirited enough to recognise that they must move with the times; and while the horse was a most valuable animal, they had to recognise that they had to make greater progress to-day, and to make more

USE OF MECHANICAL POWER

in the cleansing of their streets than they had in the past. He recognised that they had to take into account not the present cost of a horse and the price of provender, but the cost and the price before the war. Mr. Greig's paper was based on that calculation. They had given this question careful study in Glasgow, because they had had more experience of motor sweeping there than in any other town in the United Kingdom. They had at present a fleet of twelve motor sweepers. They had not confined their attention only to one company, but they had three different classes of motor sweepers. Mr. Greig did not say which was the best, but he might give the information privately. He congratulated Mr. Bee on living in a district where he had to water the streets forty-eight days in two months. In Glasgow they were fortunate if they were called upon to water the streets forty-eight hours in two months.

Councillor Tebitt (Southampton) said that, while he was in sympathy with any movement in favour of traction motors, he was not satisfied that the method of collecting refuse and street watering had been improved. Still they were working on the right line. It was suggested on the previous day that if they bought anything out of revenue there was no need to provide for interest. With that proposition he entirely disagreed.

* See The Surveyor, July 21st.

Mr. W. J. Steele (city engineer of Newcastle) said he agreed with the president that, whether they used horses or mechanical vehicles for their work was only part of the whole. The president had said that the question must be looked at in a broad light, and explained it by saying that the motors he used damaged the streets, and therefore it was a question whether any advantage they might save in scavenging was really a saving to the ratepayers on the whole. One of the best books of statistics he had seen was issued by the London County Council, and in an excellent preface the clerk to the council said that any

COMPARATIVE FIGURES

were of no avail unless based on the same standard. Personally, he was thankful to all gentlemen who had given figures, but he would not like to base a single conclusion on any one of the figures given. Unless, for instance, figures showed the whole of the cost of the alteration of a system they were of no value. He would suggest that the committee should base a standard of tables for statistics, so that in making comparisons the whole of the figures should be on one standard. He did not think it was altogether a question of cost, because they had to consider the economy of the nation as a whole. Supposing, by any additional cost, 2d. or 3d., or whatever it might mean in the £, upon any work the municipality might do, they saved so many lives per annum, or they decreased the rate of sickness, that was all to the good of the nation, and particularly after the war, so that the question of a mere little detail was of small moment.

Councillor Diggle (Rochdale) said it seemed to him that the Blackpool vehicle was an expensive machine. To have £1,000 in a machine hung up for at least half the year seemed to him to be extravagant. It did not seem to him that the experience of Blackpool was of much use to industrial towns.

Mr. T. H. Whitewick (Surbiton) said he had had two steam motors, one of which had been worked nine years and the other six years. They worked from eight to twelve hours a day, and he found them very satisfactory. They were used for watering, sweeping, flushing, hauling, and steam rolling for light work. He found the sweepers only lasted ten days with the motor against seventeen days with the horse, but they did a much greater mileage.

Mr. W. H. Hamblett (Salford) said it was possible for the water tank to be taken off the Blackpool machine and the machine turned into a refuse carrier during the winter months.

Alderman Brown (Blackpool) said that Mr. Bee had found work for the machine all the year round. The corporation had never bought anything which gave them greater satisfaction than the water sprinkler.

The President (Mr. W. Harpur) said he agreed with Mr. Steele's remarks that, in arriving at the cost of anything, everything, including interest, sinking fund, and establishment charges, should be included. They could not arrive at the proper cost of an article if these items were not added on. Mr. Steele also suggested there should be standards for arriving at the cost of these different articles. He was glad to tell Mr. Steele that a committee had been appointed by the institute to standardise a form in which these costs should be based and arrived at.

Mr. Greig, replying to the discussion, said they had no experience in Glasgow of working the machine on the double shift. He agreed with Mr. Priestley that if they had worked a night shift the results would have been better. As to the mobility of the horse, under certain conditions the machine could be used in a snowstorm, but when the snow was lying a depth of 6 in. the machine was of no use whatever. He agreed with Mr. Steele that the institute ought to have a standard of figures, otherwise comparisons were useless. Motor sweepers required less accommodation than horse-driven machines, and this should be borne in mind when making comparisons between the two classes of traction. As to the length of

LIFE OF BRUSHES,

he found in Glasgow the sweepers covered about 210 miles with one brush, the pressure on the road being more evenly distributed by the motor machine.

Mr. Bee, in his reply to the question as to how they saved £50 on water, said it had been their method before the war to spray with the hose pipe, but they were short of water and labour, and now did this work with the electric motor on the sweeping machine.

Alderman Brown, interposing, said that they formerly paid the engineer's department for the water. Now they did not. That was how they saved the £50.

Mr. Bee said the motor had displaced six horses, and when the second vehicle arrived it was their intention to dispose of all the horses employed on the work. The machine now in use was paid for out of revenue. The battery on it was guaranteed for two years, and he put depreciation down at £12. Mr. Bee added that the machine had been used for refuse collection in the winter.

The vote of thanks to the speakers was carried.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why should the minds of some of the members of the Lewes Town Council have been exercised because some fencing was taken from the cemetery, presumably because it was not wanted, and erected at the sewage disposal works where it was needed? Why should it be "incongruous," as one member stated, to do this, and was it objected to because the fencing was taken from consecrated ground? Is not this going a little too far with sentiment?

* * * *

Apropos of consecrated ground, who was responsible for the following story? A council were experiencing some trouble in having consecrated a small portion of ground which they had added to the cemetery, and after listening for a short time to the discussion, one of the members rose and said: "Mr. Chairman, I don't see no difficulty about this; I had my back yard consecrated a month ago and now it is as dry as a bone."

* * * *

Was there not a good deal of truth in the statement made recently by the Deputy Minister of Highways at Ontario that "Nations have prospered without railways, but common roads, 'good roads,' have always been vital to national development and progress"? What will be the condition of this country if, owing to mistaken war economy, our roads are neglected and allowed to get into a state of disrepair?

* * * *

Do not the idealists in connection with town planning sometimes ask for such expensive schemes that they rather frighten local authorities, who are obliged to study the ratepayers' pockets? For example, is it not asking rather too much to say "that all roads should have the buildings 60 ft. apart, measured from opposite sides of the road, and that each building should be set back 10 ft. from the road"? Who is to pay for the land thus given up, and who is to pay for the upkeep and cleansing of roads of such dimensions? Are such widths really necessary in some roads?

* * * *

Would it not be interesting to know what salary is paid to the surveyor of Barkisland, Yorks, Urban District, who continues not only the work of surveyor to this district, but also that of waterworks manager and rate collector? What are the other duties of this official, who was recently granted exemption from military service until September 1st? Could there be any doubt that such a man was a real "indispensable"?

* * * *

Are there not a large number of problems which will have to be faced after the war, such as the restoration of our roads, housing the labouring classes, town planning, the completion of half-finished schemes, the reconstruction—on more modern lines—of sewage disposal works, better provision for the collection and disposal of house refuse, larger combined water supply schemes, and defences against sea encroachments? But how will these be paid for, in addition to the repayment of the huge national debt which is mounting by leaps and bounds every minute that the war lasts?

* * * *

Will not the late Mr. John Hutchinson, who did so much towards the improvement and simplifying of laboratory work in connection with bituminous road materials and tars, be greatly missed by road engineers? Was not his personality one that is not likely to be easily forgotten by his many personal as well as professional friends?

Surveyors: Their Security of Tenure and Defence.*

By J. H. DREW, M.Inst.C.E., Borough Surveyor of Grantham.

Although "security of tenure" has been referred to from time to time in presidential addresses to the Institution of Municipal and County Engineers, and in the reports of the "Proceedings" of the council, the author is not aware that a paper has previously been submitted for discussion at an annual meeting, and this must be his excuse, if one be needed, for asking the members to give the subject their serious thought and consideration in the interests and welfare of municipal surveyors as a body, and not merely from the point of view of individuals.

For some reason or other, our esteemed retiring president (Mr. Wakelam) made no reference in his presidential address in June last to the question of "security of tenure," although it is well known to many members that for years he has been working assiduously in the direction so frequently indicated by his predecessors. A few years ago Mr. Wakelam and Mr. W. H. Prescott endeavoured to formulate a mutual defence scheme, but their efforts came to nothing; since then the council of the institution has taken a ballot of the whole of the members, but only a very small percentage took the trouble to return their ballot papers; while still more recently an association registered as Official Security, Limited, has been founded, but only 1 per cent of the members of this institution have joined. Is it that members are absolutely indifferent, or do they want something for nothing?

OFFICIAL SECURITY, LIMITED.

This association—*i.e.*, Official Security, Limited—has been formed on co-operative lines by public officials to effect policies of insurance against loss or diminution of official salary, litigation risks, and larceny of money in transit, and its members comprise head officials in all branches of local government work. The articles, forms of policies and contracts were settled by eminent King's Counsel.

The scheme has been approved and adopted, after careful inquiry into its financial basis, by the Institution of Municipal and County Engineers, the Association of Rate Collectors and Assistant Overseers, and the London, Liverpool and Manchester Incometax Collectors' Association. The very low premium of 5s. per cent is charged for normal risks for security of tenure, with three years' salary as compensation. The litigation policy of 5s. per cent is specially valuable and attractive. For instance, one member was defended successfully in police court proceedings at a cost of £29 2s. 6d. (which he would otherwise have had to bear personally), in respect of an assault by one of his councillors. The premium paid by this member was only 10s. The larceny policy covers loss of money in transit and while at the office or house until banked at 5s. per cent. Complete security is attained by Official Security, Limited, underwriting with a strong group at Lloyd's, having an annual premium income of £200,000, a part of all risks not covered by the company's own funds consisting of an issue of debentures, premium income and surplus profits.

The attitude of this association towards surveyors as a class is that, owing to their control of the chief spending department of local authorities, and the supervision of the employment of labour and necessary connection with labour disputes, building by-laws, and the administration of various Acts of Parliament, their offices constitute a risk of insecurity of tenure probably double that of other officials. Hence, while surveyors are admitted to the scheme on the same terms as others, no special efforts to canvass them are made, as an undue proportion of such risks would endanger the funds of the association, especially during the present war, when the further risk of reduction of staffs and salaries consequent upon the restriction of capital outlay upon engineering works has to be faced. The author submits that these considerations prove that a scheme restricted to surveyors alone could not be so commercially sound as one embracing other less risky offices, the combination of which tends to give a fair average rate of loss which can be covered by a moderate premium, within the means of the less highly paid officers.

* From a paper submitted at the annual meeting of the Institution of Municipal and County Engineers.

The author wishes to bring prominently to the notice of members the

UNFAIR AND INEQUITABLE POSITION OF SURVEYORS

in comparison with other local government officials who in their respective duties have more or less protection from dismissal by appeal to a central authority.

Even an appeal to the Local Government Board may prove the official concerned to be resting upon a broken reed. There is on record a case of a medical officer of health not far from London who was called upon by his council to resign, and he was suspended from office. He appealed to the Local Government Board, who at this time saw no reason for the action of the council, and communicated accordingly to that authority, and the medical officer was duly reinstated. Rhetorical threats were made by members of the council to resign in consequence of the attitude of the Local Government Board. Further trouble and allegations followed, and on a second application to the Local Government Board the medical officer was dismissed.

Although the author believes that Mr. John Burns, when President of the Local Government Board, had a good deal of sympathy for members of our institution when the case for surveyors was laid before him, he is reputed to hold the view that if an official should have any friction with his council—even if that friction were caused solely by zeal and attention to duty—it would be better for the official to resign.

Mr. H. Samuel and Mr. Walter Long, by their attitude towards medical officers of health and sanitary inspectors, have shown that they more fully appreciate that in the administration in an impartial manner of the various Acts, by-laws and regulations, it is almost impossible for officials to steer clear of vested interests and subsequent unpleasantness, particularly in the smaller districts where local influences are more keenly felt than in the larger towns and cities. A surveyor has not even the right of appeal to the Local Government Board.

RISK OF LOSS OF OFFICE OR REDUCTION OF SALARY.

The risk of a surveyor losing his post otherwise than from his own misconduct is an extremely variable one, dependent upon a variety of causes, constantly shifting its storm centre, and often falling upon the most unsuspecting victim like a stroke of lightning. Amalgamation of one or more districts into a combined district or borough often results in a surveyor being thrown out of a situation, with meagre and inadequate compensation for loss of office; and especially so with a surveyor having only short service. The cry for economy and the work of Retrenchment Committees is a very frequent and favoured method of reducing expenditure, and often no consideration is given whether the dismissal of a member or members of a staff will impair the efficiency of the department. Reduction of salaries has been mooted, and may in some towns and districts be carried out on the plea of necessity and "war economy"; dismissals have already taken place.

NECESSITY FOR TENURE OF OFFICE.

The author believes that at the present time our case requires little, if any, proof to convince the present President of the Local Government Board that security of tenure is just as necessary for surveyors as other health officers, and the problem we, as an institution, have to solve is to find a scheme which will secure for surveyors the object at which we aim. It is very probable that if security of tenure were to be obtained by the right of appeal to the Local Government Board or some other central tribunal, the Government would insist upon having a voice in the future appointments and qualifications of surveyors, to satisfy themselves that only competent candidates were appointed to surveyorships, and the author considers that no member of our own or other properly constituted institution could cavil at this.

Is there a member of the institution who will uphold that security of tenure is not absolutely necessary, not only as a protection to surveyors, but also to the better and more impartial administration of local government than the conditions of employment

obtaining to-day can possibly admit? To err is human, and often one has to decide whether it is worth the worry and anxiety to place in the balance the risk of losing one's appointment on the one hand, and a strict and rigorous combat for the enforcing of some Act of Parliament, by-law or regulation on the other. An official may gain his point to-day, but what will the morrow bring? Insidious and tortuous are the ways of the malicious, and the appointment of surveyor is only held during the will and pleasure of the council employing him. This hard fact is always looking one straight in the face, and many members will, no doubt, at some time or other in their careers, have come to a sudden stop at this hurdle in their path of duty.

(To be concluded.)

PERSONAL.

Mr. J. Thomas, surveyor to the Gwyrfai Rural District Council, has resigned, and the council have appointed the clerk (Mr. D. G. Jones) and the sanitary inspector (Mr. D. Price) to perform his duties.

Mr. Charles le Maistre, Assoc.M.Inst.C.E., M.Inst.E.E., who has been in charge of the work of the electrical section since 1903, has been appointed secretary to the Engineering Standards Committee in succession to the late Mr. Leslie S. Robertson, M.Inst.C.E., who was lost with Lord Kitchener in the disaster to H.M.S. "Hampshire," while on an important Government mission.

KILLED IN ACTION.

Mr. T. Wood, surveyor to the Mutford and Lothingland Rural District Council, has lost his son in an engagement at the Front.

Mr. Alexander Brown, son of Mr. Angus Brown, formerly burgh surveyor of Wishaw, has, we regret to state, been killed at the Front. He was twenty-six, and a professional associate of the Surveyors' Institution.

Mr. E. B. Boothby, a much-respected member of the firm of Tuke & Bell, Limited (the Carlton Engineering Works, High-road, Tottenham, London, N.), who held a commission in the 13th Rifle Brigade, and was in charge of a machine gun section, was killed in action, we regret to state, on July 11th.

Reconstruction at Dublin.—In the House of Commons on Wednesday Mr. H. Samuel introduced a Bill to amend the law as to the erection of buildings and the making and improvement of streets in connection with the reconstruction of areas, streets, and buildings recently damaged or destroyed in Dublin, and for other purposes incidental, and it was read a first time.

Timber, Plywood, and Woodwork.—Our readers will no doubt be interested in a page advertisement in our issue of next week, which will give various particulars of timber, plywood, and woodwork which Messrs. C. Jennings & Co. have for sale. The page will be found useful for reference by all who make use of such goods. The firm's head office is at Pennywell-road, Bristol, but they have branches at Leicester, Porthcawl, and stocks warehoused at Swansea, Hull, Pembroke Dock, Neyland, Newcastle, Manchester, Liverpool, and elsewhere.

Municipal Employees' War Allowances.—Doncaster Town Council on Wednesday decided to continue to pay one-half to one-third wage war allowance to employees who presented themselves for attestation or enlistment prior to the date of closing of Lord Derby's first scheme; such one-half or one-third allowance to be paid whether or not the amount plus the Army pay and separation allowance, exceeds the civil remuneration, provided the Local Government Board consent. Employees who attested or enlisted subsequent to the date of the closing of Lord Derby's first scheme, and had not presented themselves for attestation or enlistment prior to that date, are to be entitled to one-half or one-third war allowance provided they had at the time of attestation or enlistment been for six months in the corporation service, and had attested or enlisted before the passing of the Military Service Act dealing with them respectively; and that the amount of the soldier's pay, separation, and other allowances, does not exceed their civil employment pay.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Gloucester T.C. (July 25th. Mr. W. O. E. Meade-King).—£1,606 for excess expenditure on works at the outfall sewers.—The town clerk, Mr. G. Sheffield Blakeway, stated that the work of improving the city outfall sewers was commenced on March 30, 1913, and had now been completed. The original amount authorised to be borrowed was £17,491, which was expended in payment to two contractors, the one carrying out the sewer work and the other the construction of a tunnel under the river Severn. The actual work originally provided for had been carried out at a lower cost than estimated by the engineer, but it had been found necessary to deepen the shafts on each side of the river and lengthen the syphons, and to widen the distance between the shafts and the river bank, with a resultant extra cost, including other small items, of £1,606.

Ilfracombe U.D.C. (July 27th. Mr. P. M. Crosthwaite.)—This was an enquiry with respect to the appeals of Miss E. Potter and Mr. W. C. Hutchings, regarding the apportionment for St. Brannock Park-road, taken over by the urban council. Mr. Hutchings objected to the apportionment of £9 4s. 6d. for making up the road, as he had not had any notice either preliminary or final. The road did not require repair, as the previous owner had done all that was necessary. While the first cost of making it up was estimated at £253, the actual cost was £443.—The surveyor (Mr. O. M. Prouse) said that was due to the alteration in the class of road decided upon.—Mr. Hutchings said the road should not have been made up until building operations had ceased.—Mr. Rowe said the notices had been sent to Miss Potter, but had been returned through the post. With regard to the increased work, power was given under the Act to amend, and no illegal action had been committed.—The inspector said he would visit the locality and report in due course.

Sheffield T.C. (July 26th. Mr. George L. Pepler).—This was an inquiry into an application for authority to prepare town-planning schemes in respect of two city areas.—It was stated by the deputy town clerk, Mr. E. B. Gibson, that in respect to the two areas known as Nos. 4 and 5, no objections had been put in with regard to the former, and it was only necessary to deal at length with No. 5. No. 4 area included Stumperlow, Fulwood, and Whirlow; and No. 5, Bannercross, Brincliffe, Kenwood Park, &c. The latter had an area of 142 acres. It was within reasonable distance of the city, and enjoyed excellent tramway facilities. It had been partly developed, and was also in course of further development. The corporation were desirous that the town-planning scheme should operate over the district with the object of limiting the houses per acre and securing the amenities of the neighbourhood. Mr. E. Partington, improvements surveyor to the corporation, described the density of housing in the adjacent estates. In Gainsborough-road there were eleven houses to the acre, in Machon Bank-road forty-nine to the acre, and in Osborne-road thirty to the acre. In the Violet Bank-road the density was twenty-six and a-half houses per acre. In another place 109 houses had been erected on an area formerly occupied by one house. It was this sort of thing which the corporation desired to control.

APPLICATIONS FOR LOANS.

Birkenhead T.C.—£2,500 for the provision of benzol recovery plant at the gasworks.

Rochester T.C.—£7,020 for the main drainage scheme.

FORTHCOMING INQUIRY.

SEPTEMBER.

Town Planning. £

13. **Neath.** (Mr. George L. Pepler) ... ... —

Road Tarring in Surrey.—In his annual report on the main roads, Mr. A. Dryland, the county surveyor of Surrey, states the expenditure on tarring outside certain urban districts was £13,362, of 1·73d. per yard, the length of roads tarred being about 157 miles. Owing to higher prices, the cost increased by ·11d. per yard super.

Municipal Work in Progress and Projected.

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The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

East Sussex C.C.—It has been agreed to meet the Kent County Council with respect to the repair of Brim Bridge by subscribing towards the cost a sum not exceeding £70.

Edinburgh T.C.—The Electric Lighting Committee recommend an extension of the McDonald-road power station, at an estimated cost of £1,300.

Essex C.C. It is proposed to build a school for 150 girls at Brentwood and a school for 470 boys at Leyton.

Grimsby T.C. It has been agreed to proceed with the erection of a corrugated iron building as a temporary fire station.

Guiseley U.D.C.—The council, at a meeting in committee, considered a request from the military authorities for the provision of an auxiliary hospital in Guiseley, and a resolution was passed to invite subscriptions for the purpose of equipping the town hall with beds for twenty-five patients.

Okehampton T.C. Tenders are to be invited for the construction of a cattle market in Lodgeroad.

Torquay T.C.—A tender at £143 has been accepted for heating the bath-rooms at the Bath Saloon by steam radiators, this being in addition to the architect's estimate of £75 for builder's work.

HOUSING AND TOWN PLANNING.

Coventry T.C. The annual accounts of the Housing Committee show a loss of £563. It was stated that the chief causes of the deficiency were the rise in the rate of interest and taxes. In the houses which were being finished the rents were being raised on occupation, and the committee were fixing the rents at Stoke Heath at a figure which would ensure there was no loss.

Southend T.C. It has been agreed to apply to the Local Government Board for sanction to prepare a town planning scheme for the eastern area of the borough and portions of the Shoeburyness urban and Rochford rural districts.

Shrewsbury T.C.—Authority has been given the Improvement Committee to apply to the Local Government Board for permission to proceed with a town planning scheme. The committee submitted details of an arrangement which had been arrived at for laying out Lord Barnard's Raby estate adjoining Belle Vue Gardens, and Longden road on town planning lines, and these were approved. Lord Barnard gives up 3,500 yds. for widening Longden-road, and the cost for widening is estimated at £2,600.

MOTOR TRANSPORT.

Coulsdon and Purley U.D.C.—It is proposed to purchase a motor hose van.

Poplar B.C.—It is proposed to purchase a motor-car for the works department at a cost not exceeding £600.

Salford T.C.—The council on Wednesday approved of a proposal by the General Purposes Committee to purchase four motor ambulance vans for the conveyance of wounded soldiers to and from hospitals, and to present them to the Red Cross Society. It was stated that the action of the corporation in this matter had already served as an example to others, with the result that thirteen other motor ambulances had been forthcoming.

Surbiton U.D.C.—The removal of house refuse by motor vehicles is being considered by the council.

Tynemouth T.C.—It has been decided to purchase a motor fire engine.

PARKS AND OPEN SPACES.

Bradford T.C.—A new recreation ground for the Little Horton district—the fifth added to the open spaces of the city this year—was opened last week. It is about 12,640 sq. yds. in extent, and was taken over by arrangement from the Street Improvement Committee.

Golcar U.D.C.—Arrangements are being completed for adapting a plot of land between Leymoor Top and Swallow-lane, on the Savile estate, as a park and recreation ground.

REFUSE COLLECTION AND DISPOSAL.

Bristol T.C. The city engineer, Mr. L. S. McKenzie, reported that a commencement had been made with the collection of waste paper. A number of circulars explaining what was required of householders had been issued and 5,500 sacks distributed. So far only 10 tons of waste paper had been collected, but the amount would rapidly increase and the system would shortly be extended to other districts.

Nantyglo and Blaina U.D.C.—The surveyor, Mr. W. J. Davies, has been instructed to report on the provision of a refuse destructor for the district.

ROADS AND MATERIALS.

Bexhill T.C. The Road Board have sanctioned a grant of £300 towards the cost of repairing Barnham road.

Branston R.D.C. It has been decided to purchase a tar-sprayer at a cost of £25.

Bungay U.D.C. The council have accepted the tender of the Mountsorrel Company for a supply of granite at 16s. 6d. per ton, and for steam rolling at 27s. 6d. per day.

Clonakilty R.D.C.—The council have approved an estimate, at £580, for repairs to the road from Clonakilty to Ring.

Cumberland C.C.—Consideration is being given by the Highways Committee to the repair of the roads in the Longtown district from Kingstown to the Scottish boundary, and the improvement of the road from Sark Bank House, on the Glasgow main road, to its junction with the Longtown Springfield road.

Dorset C.C.—The Road Board have offered to lend the county council £7,000, free of interest, for seven years, for the construction of a new coast road at Lyme Regis. German prisoners of war are to be employed in the work.

East Riding C.C.—The Highways and Bridges Committee recommend the county council to contribute £350 towards the purchase of a second steam roller by the Bridlington Rural District Council.

East Sussex C.C.—The county council have adopted a proposal to inform the urban authorities that, in consequence of the difficulty experienced in obtaining ordinary macadam, the council would allow the use of tarred macadam during the current year for the repair of main roads.

Lindsey C.C.—The county surveyor, Mr. J. Thropp, reports that owing to the difficulty of getting tar and chippings, only a portion of the main roads have been tar-sprayed. He also reports that the Road Board have consented to contribute £747, being one-half of the estimated cost of the tar-spraying recommended by the Highways Committee.

Mallow U.D.C.—It has been agreed to expend an additional sum of £200 on the main street improvement.

North Riding (Yorks) C.C.—The county council have passed the following grants for the improvement of roads: Resurfacing with tarred macadam the York and Northallerton road between Easingwold and Fleet Bank, £3,896 (Road Board grant £1,400); Darlington and Boroughbridge road, between Blackman Plantation of Croft, £1,700 (Road Board grant £600); tar-spraying various roads in the Riding, £3,386 (Road Board grant £1,000); Whitby and Pickering road, tar-spraying in the Pickering rural district, £660 (Road Board grant £369); Richmond and Darlington road, strengthening and repairing £3,087 (Road Board grant £1,000).

Notts C.C.—In the report of the Highways Committee it was stated that the Road Board had agreed to make a grant to the council of £1,555 towards the cost of surface tarring which it is proposed to carry out this summer on Tarmac roads. Sir Lancelot

Rolleston stated that the committee were endeavouring to prevent what was happening in many parts of the country namely, the deterioration of the roads. In that he believed they were succeeding, and the roads were rather improving. He also mentioned that the work of widening Thackham's-lane at Chilwell, and the construction of the new road across the fields from Attenborough lane, had been commenced. The cost would be £9,200, £6,000 of which was for a new bridge.

Salop C.C.—It was reported that the Road Board had forwarded grants aggregating £2,200 in respect of tar-surfacing and tar-painting improvement works to be carried out on rural main roads during the ensuing year. Additional grants had also been received for surface tarring a number of main roads for military purposes.

South Stoneham R.D.C.—A scheme, supported by voluntary subscriptions, is being promoted for the repair of Broadlands-road, Hampton Park. The surveyor of highways, Mr. F. Heather, who has collected between £60 and £70 on behalf of the fund, has been thanked by the council for the trouble he is taking in the matter.

Surrey C.C.—The Trinidad Lake Asphalte Company, who have had a contract with the council for the last five years for the maintenance of the London and Portsmouth road within the district of the Maldens and Coombe at 1s. 2d. per yard super., have agreed to continue the work for another five years at 1s. 5d. per yard.

West Sussex C.C.—A resolution has been passed affirming that in view of the large increase of heavy motor traffic on the roads, it was most important that heavy motors should pay a tax or contribution towards the expense of the upkeep of the roads commensurate with the use they make of them.

SEWERAGE AND SEWAGE DISPOSAL.

Coulsdon and Purley U.D.C.—The council recently sealed an agreement with the Croydon Corporation for the reception and disposal of the local sewage. The question has been under discussion by the two authorities for some years, and the completion of the negotiations has been received with much satisfaction. Practically it means that the urban council will pay 7d. in the £ for sewage disposal over a larger area than under the old agreement, while the differing charges of 6d., 8d., and 1s. will be done away with.

East Riding (Yorks) C.C.—The county council have agreed to get the attention of Parliament called to the "failure of the War Office and the Local Government Board to give attention to the repeated representations made by the council" with respect to the disposal of sewage at a certain military camp.

Martley R.D.C.—It has been decided to take up a further loan of £1,000 for the Hallow sewerage scheme.

Melton Mowbray R.D.C.—The sanitary inspector has submitted a preliminary report on the sewerage and sewage disposal of Asfordby Hill. He proposed, subject to arrangement with various parties concerned, to carry a 6-in. sewer across the Asfordby tunnel and county council garden to join the main sewer running down the Pasture Hill to the valley. It would be also necessary to find a new site for the treatment of the sewage, the combined volume of which, from the hill and valley, would be 36,000 gallons per twenty-four hours. He had selected as a site for the farm a field on the glebe land, and the area they would require to take would be about 1 acre. The sewage from the valley would require lifting to the new site, and he proposed to do this by means of an automatic lift. An approximate estimate of the cost was £1,723.

Middlesex C.C.—The county council adopted recently a strongly worded recommendation by the Rivers Committee relating to the condition of the Wembley sewage works owing to the action of the Local Government Board in refusing sanction to a loan for their reconstruction.

Woolwich B.C.—With regard to the supervision of drainage work in connection with the hutments and hostels now being erected in various parts of the borough, the Works Committee have reported that the War Department is exempt from the operation of the Metropolis Management Acts and the London County Council by-laws relating to the construction and supervision of sewers and drains. Plans in connection with these buildings are submitted to the borough council as a matter of courtesy and for the information of the council only, and not as formal applications for the council's approval.

WATER, GAS, AND ELECTRICITY.

Barking U.D.C.—Application is being made to the Local Government Board for sanction to a loan for additional electric mains and transforming plant.

Keighley T.C.—It was reported that from a loss of £2,000 on the first year's working of the electricity undertaking there was now a profit of £758, and it was hoped to show better results in the future.

Liverpool T.C.—A special report has been presented to the Water Committee on the subject of the water supply, and it was indicated in the course of a discussion at the city council that, while economy in the use of water is imperative, an effort will be made to induce the council to rescind a recent resolution postponing the application for Parliamentary powers to construct the proposed third-line pipe from Vyrnwy to Prescot. Meanwhile plans and estimates for the project will be prepared.

Maidstone T.C.—An extension of the electric cable is to be effected at an estimated cost of £120.

Poplar B.C.—Considerable electric main extensions are contemplated in the borough, and it is also proposed to build a new sub-station in High-street.

Rotherham T.C.—A scheme is being considered for the provision of generating plant for the electricity works at a cost of £50,000.

Southgate U.D.C.—The surveyor, Mr. Sutherland, has received instruction to obtain estimates of the cost of boring and maintaining an artesian well for the public baths.

Stoke-on-Trent T.C.—The council have approved the scheme for plant extension at the central power-house, at an estimated cost of £12,000.

Widnes T.C.—Plant for the production of toluol and benzol is to be installed at the gasworks, at an estimated cost of £1,500.

Worthing T.C.—The council have agreed to the electrical engineer's proposal to fit an additional fuel pump to the larger of the two Diesel engines, at an estimated cost of £269, to enable the engine to be worked with tar oil as well as with residual petroleum.

MISCELLANEOUS.

Chiswick U.D.C.—It has been agreed to loan a piece of land on Back Common to the War Office for the purpose of a miniature rifle range.

East Sussex C.C.—An expenditure of £1,250 has been sanctioned on the dumping of shingle for the protection of the works of sea defence at Rottingdean. It was stated that the £5,000 voted some two years ago for works of sea defence at this place had been expended.

Phillack U.D.C.—Difficulty having been experienced in getting carters to do the council's work at 7s. a day, it has been decided to raise the scale of payment to 8s.

South Shields T.C.—A nett profit of £6,504 was earned by the tramway undertaking last year, as compared with £5,594 in the previous year.

Twickenham U.D.C.—All the regular men in the employment of the council have been granted a week's leave of absence, with full pay.—The gangers and general labourers on works of sewer and road maintenance have been granted an increase of ½d. an hour, from 7½d. and 6½d. to 8d. and 7d. respectively, but they are to be graded into two classes.

Willesden Paper and Canvas Works.—Although as a result of a recent fire this company's works were totally destroyed, the directors have every reasonable expectation of resuming operations by November 1st. The rebuilding of the company's factory has already commenced.

Shanghai's Roads.—"I took particular note of the excellence of your roads and the large number of motor cars," was a remark made by Dr. Reinsch, American Minister to China, to a representative of the *North China Daily News*, when leaving Shanghai on July 5th, after a four days' visit.

FOR OTHER ADVERTISEMENTS
See End of Paper.

WANTED immediately, Hire or Purchase, 6-8-ton Steam Roller; good working order.—Full particulars and lowest cash to Box 1,579, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,062)

SOME RECENT PUBLICATIONS.*

The Planning of the Modern City. By Nelson P. Lewis. Price $3.50 nett. New York: John Wiley & Sons.

Mr. Lewis's book on "The Planning of the Modern City" is a valuable addition to the literature on this subject. It is an important work for the reason that it approaches city planning from a new point of view—namely, from that of the municipal engineer. Mr. Lewis makes the point that up to the present time most of the literature has been contributed by architects who have emphasised the architectural and artistic side, and by students of city government who have regarded it as an administrative problem. Mr. Lewis's idea is that city planning is essentially the work of the municipal engineer. The engineer "is the first man on the ground," he holds the key to the situation, and should be the official most interested in the subject. At the very beginning attention is called to the necessity of correcting mistakes, and as an illustration of the difficulty, expense and time required to make changes the new "Strand to Holborn" improvement in London is referred to at length.

The present work differs from many of the books previously published in that most of the illustrations are modern. Mr. Lewis says that "while we may well look to the ancient cities for inspiration, we shall make a great mistake if we shall use them as models. Modern cities must be adapted to modern needs." The characteristic of the book which above all others will strike the attention of the reader is its sanity. Mr. Lewis, while a man of vision, is always practical. The book reflects the man, and the man ably fills his position as the chief engineer of the Board of Estimate and Apportionment of the City of New York. In many ways this is the most important municipal engineering position in the United States. The engineering profession, and especially municipal engineers, will gratefully receive this excellent treatise on city planning.

The various reports and papers of the congress on "Home Problems After the War," held in April last at Caxton Hall, London, have now been published, and are obtainable from the National Housing and Town Planning Council at the price of 5s.

THE HYDRAULIC MINING CARTRIDGE.

The hydraulic mining cartridge, a machine for breaking rock, concrete, &c., which was described in these columns some months ago, and which has been used at many electrical generating stations and in many docks and harbours during the last few years, has recently been used in connection with an important Government contract for alterations to dock walls in a North of England seaport. The work involves the disintegration of about 30,000 cub. yds. of concrete, which was laid down about twenty years ago. The walls are approximately 10 ft. above water level and 30 ft. below, and a series of holes have been drilled about 6 ft. apart and 38 to 40 ft. deep.

The upper sections, averaging about 10 ft. in thickness, are first removed to a depth of 15 to 20 ft.; below this depth divers are employed to insert the machine in the hole, pressure being applied from the pump at the surface. The power required to break the concrete varies according to the conditions of each operation, but is usually about 150 to 200 tons, representing a pressure of 6 or 8 tons per sq. in.

The breaking up of the walls by explosives is impossible in this instance, as not only is it desired to avoid explosive shots because of their effect on valuable plant and war vessels in the vicinity, but because portions of the walls below water level must be secured from damage and shock of every kind.

Besides the machines used in these important operations, hydraulic cartridges have recently been sent out to Algoa Bay for similar work.

Women Labour.—Nuneaton Corporation are employing women on the repair of the roads.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SEWAGE FARM MANAGER.—August 5th.—East Barnet Valley Urban District Council. £2 2s.—£2 10s. per week.—Mr. T. A. Buckley, clerk, Council Offices, Station-road, New Barnet.

TEMPORARY ASSISTANT INSPECTOR. — August 10th.—Corporation of Bootle. £100-£110.—Mr. J. Spencer Tumilty, town clerk, Town Hall.

TEMPORARY ASSISTANT.—August 11th.—Surrey County Council. £3 per week.—Mr. A. Dryland, county surveyor, County Hall, Kingston-on-Thames.

DISTRICT SURVEYOR.—August 14th.—Alresford Rural District Council. £150.—Mr. J. Ridley Shield, clerk, East-street, Alresford, Hants.

TEMPORARY MAIN ROAD SURVEYOR.—August 19th.—Cornwall County Council. £150 per annum.—Mr. L. D. Thompson, county surveyor, County Hall, Truro.

SURVEYOR OF HIGHWAYS.—Peterborough Rural District Council. £125.—Mr. W. B. Buckle, clerk, 49 Priestgate, Peterborough.

TEMPORARY DRAUGHTSMAN.—Corporation of Blackburn.—Borough and Water Engineer, Town Hall, Blackburn.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

BRIDGNORTH.—August 10th.—For work in connection with the construction of a wall at Winterburn Bridge, for the rural district council.—Mr. F. Richards, surveyor Oldbury, Bridgnorth.

WILTON.—August 12th.—For the repair of a bridge, for the rural district council.—Mr. R. A. Skelton, surveyor, Wilton-road, Bemerton.

LICHFIELD.—August 17th.—For the construction of a brick and concrete culvert, for the rural district council.—Mr. C. D. Rawstron, surveyor, Station-road, Lichfield.

CARDIGAN. — For cementing and waterproofing walls, constructing new lead valleys, improvements to water supply, and general repairs to a school, for the Education Committee.—Mr. G. Dickens-Lewis, county architect, Aberystwyth.

Engineering: Iron and Steel.

MANCHESTER.—August 10th.—For the supply of an electrically-driven circulating water booster pump, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

SINGAPORE.—August 14th.—For the construction of a steel bridge, for the Public Works Department.—Chief Clerk, Colonial Engineer's Office, Singapore.

BARKING.—August 15th.—For the supply of extra high-tension cables, main switchgear, sub-station switchgear, and transformers, for the Electricity and Tramways Committee.—Mr. W. E. Kidner, acting engineer and manager, Electricity Works, East-street, Barking.

LONDON.—August 22nd.—For the supply of 1,000 forged steel driving wheel tyres, and 500 forged steel trailing wheel tyres, for electric tramcars, for the county council.—Chief Offices, London County Council Tramways, 62 Finsbury-pavement, E.C.

STOCKBRIDGE.—For the creation of 80 yds. of fence and 60 yds. of retaining wall, for the rural district council.—Mr. W. J. Ayles, district surveyor, Broughton, Stockbridge.

Roads.

BASINGSTOKE.—August 10th.—For steam rolling, for the rural district council.—Mr. R. Forrester, surveyor, Chequers-road, Basingstoke.

ROMFORD.—August 14th.—For the supply of 920 tons of granite, for the rural district council.—The Highway Surveyor, 16a South-street, Romford.

JOHANNESBURG.—August 14th-15th.—For the supply of 1,600 tons of tar or tar substitute, for the municipal council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

LONDON.—August 15th.—For the supply of 370,000 creosoted deal paving blocks, for the county council.—Chief Officer, L.C.C. Tramways, 62 Finsbury Pavement, E.C.

SCUNTHORPE.—August 30th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, 110 High-street, Scunthorpe.

Sanitary.

CHEADLE.—August 10th.—For the construction of an additional catchpit at the sewage works, for the urban district council.—Mr. F. R. Gibbins, Council Offices, Cheadle.

WANDSWORTH.—August 21st.—For surface water drainage works at Wandsworth Cemetery, Magdalen-road, Wandsworth, for the borough council.—Mr. P. Dodd borough engineer, 215 Balham High-road, London, S.W.

Stores.

GOSPORT.—August 10th.—For the supply of artificial stone paving, broken stone for macadamising, brooms, castings, cement, lime, disinfectants, stoneware pipes and ironmongery, for the urban district council.—The Surveyor, Town Hall.

ROCHESTER.—September 5th.—For the supply of road metal, brooms, horse hire, and tools, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

Miscellaneous.

PLYMOUTH.—August 7th.—For the supply of a motor van, for the corporation.—Chief Constable, Central Police Office.

WARSOP.—August 14th.—For laying out a portion of the new burial ground, for the urban district council.—Messrs. Vallance & Westwick, White Hart-chambers, Mansfield.

SOUTHAMPTON.—September 4th.—For dredging work in the River Itchen, for the Harbour Board.—The Engineer, Harbour Board's Offices.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ERITH.—For laying cast-iron and stoneware sewers and air main, construction of an ejector chamber, and the installation of three ejectors, for the urban district council.—Mr. H. Hind, surveyor.

A. Hyslop, South Wales	£4,708
H. Farrow, Brixton, S.W.	4,429
G. Wimpey & Co., Hammersmith, W.*	3,997

ERITH.—For the extension of the open-air swimming bath, for the urban district council.—The Surveyor:—

— Myall, Southend-on-Sea	£595
R. N. Marrable, Leytonstone *	527
Friday & Sons, Erith *	472

SOUTHAMPTON.—For the construction of a conduit for electric mains, for the Harbour Board.—The Engineer:—

Grounds & Newton, Bournemouth	£154
J. Douglas, Southampton	130
C. Daysh, Southampton	105
J. J. Udall & Co., Limited, Southampton *	103

APPOINTMENTS OPEN.

SURREY COUNTY COUNCIL.
COUNTY SURVEYOR'S DEPARTMENT.

Temporary Assistant (ineligible for Military Service) required with a knowledge of Surveyor's accounts, shorthand, and typewriting. Salary £3 per week. Applications and testimonials to reach the undersigned by Friday, 11th August.

A. DRYLAND,
County Surveyor.

County Hall,
Kingston-on-Thames. (3,057)

COUNTY BOROUGH OF BLACKBURN.

WANTED at once, Temporary Draughtsman for Waterworks Department. Must be ineligible for Military Service. Apply, stating salary required, experience, and full particulars, to the Borough and Water Engineer, Town Hall, Blackburn. (3,056)

TENDERS WANTED.

SCUNTHORPE URBAN DISTRICT COUNCIL.

SUPPLY OF ROAD MATERIAL.

The above Council invite Tenders for the supply of any quantity up to 400 tons of Broken Granite of approved quality, delivered in trucks, carriage paid at Frodingham Station, G.C. Railway.

Official Tender Forms and further particulars may be obtained at the office of the Engineer and Surveyor (Herbert Heap, Assoc.M.Inst.C.E.), 110 High-street, Scunthorpe.

Tenders, duly sealed and endorsed "Granite," are to be addressed to me and delivered at the Council's Offices, 110 High-street, Scunthorpe, on or before Wednesday, the 30th day of August, 1916, and must be accompanied by an average sample of the material.

The Council do not bind themselves to accept the lowest or any Tender.

GEORGE E. DAVY,
(3,061) Clerk to the Council.

METROPOLITAN BOROUGH OF WANDSWORTH.

TO CONTRACTORS AND OTHERS.

THE WANDSWORTH BOROUGH COUNCIL invites TENDERS for SURFACE-WATER DRAINAGE WORKS at WANDSWORTH CEMETERY, MAGDALEN-ROAD, WANDSWORTH, S.W.

The Specification, Drawings, and Form of Contract may be seen, and Forms of Tender obtained, at the Office of the Borough Engineer, Mr. P. Dodd, M.Inst.C.E., 215 Balham High-road, S.W.

Tenders (each enclosed in a sealed envelope, endorsed "Tender for Surface-water Drainage Works, Wandsworth Cemetery") are to be delivered at the Council House, East Hill, Wandsworth, S.W., or may be placed by the person tendering in the box provided for the purpose, not later than 12 o'clock noon, on Monday, the 21st August. No Tender will be received unless it is made upon one of the Forms issued for the purpose.

The Council does not bind itself to accept the lowest or any Tender.

D. A. NICHOLL,
Town Clerk.
July 26, 1916. (3,059)

APPOINTMENTS WANTED.

DEMONSTRATOR.—Lady, experienced (Naval Officer's daughter), requires permanent position; gas, electric light, domestic patents, or similar.—Reply, stating remuneration offered and full particulars, Box 1,576, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,044)

YOUNG Gentleman (20 years), with army discharge, requires appointment in Architect's or Surveyor's Office. Tracing, designing and clerical work. Good professional references. Apply W. E. Jefferiss, "Elm Villa," North-street, Romford. (3,060)

EX-PUPILS AND JUNIOR ASSISTANTS.

CIVIL Engineering and Surveying Assistant (23), rejected for military service, desires appointment. Passed A.M.I.C.E. Exam., is A.M.Inst.M. and Cy.E. Seven years in Municipal Engineer's office. Good draughtsman, surveyor and leveller.—Box 1,578, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,055)

MISCELLANEOUS.

WANTED, The Surveyor, Vols. 24 to 42 inclusive, and Vol. 44, in publishers' cases or unbound. Offers to the Publisher, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

The Surveyor

And Municipal and County Engineer.

Vol. L. AUGUST 11, 1916. No. 1,282.

Minutes of Proceedings.

Security of Tenure.

The paper by Mr. J. H. Drew entitled "Surveyors: Their Security of Tenure and Defence" was among the "slaughtered innocents" at the Blackpool meeting; otherwise there can be no doubt that there would have been a lively discussion on a matter which so materially affects the members of the institution. That there is among the members a surprising amount of apathy on the subject is proved by the result of the efforts to formulate a mutual defence scheme, which, in spite of strong backing from influential members of the institution, came to nothing a few years back. This apathy is all the more surprising as there are many well-known cases where surveyors have been unfairly and badly treated. The nature of their profession frequently makes it necessary for them to sit in judgment on some member of their council, and as a result they are often subjected to petty persecutions, which are intolerable in the case of a sensitive man. The security afforded by the Local Government Board to medical officers of health and sanitary inspectors makes the case of the surveyor still more anomalous. If it is necessary in one case more than another it is surely in that of the surveyor, as the official whose duty will most likely bring him into collision with some member of his council. The jerry-builder and land-jobber still find a way on to many councils, and the surveyor cannot expect to get a sympathetic support from them in his efforts to see that the by-laws relating to new buildings and streets are properly carried out. Improvements carried out either under the Town Planning or the Public Health Acts frequently rouse considerable and bitter opposition from influential ratepayers, and while human nature remains unchanged a scapegoat will be most often found in the poor surveyor. In the larger towns or the county councils the surveyor's lot is generally much happier than in the smaller districts. The class from which the more important towns and counties draw their councillors is generally better than in the smaller urban and rural districts, and there is safety from the influence of small cliques in the greater number of councillors on the big council. One bitter and unscrupulous councillor, always on the pounce, can in a small district frequently make an official's life hardly worth living. There are so many ways in which this petty spite can be wreaked on a man who is unable or unwilling to see eye to eye with his councillors, that it is only against the most glaring case of injustice that protection can be provided. The cry for economy is often raised by these men as providing a means of "straffing" the surveyor by giving them an opportunity of moving a reduction in his salary. On occasion this spite goes further, and leads to the surveyor being thrown out of office without compensation or provision in any shape or form. Even in the case of amalgamation, if the surveyor who may have had twenty or thirty years' municipal experience with various councils has only had a few years' service with the amalgamated district he may find himself stranded with a paltry and inadequate compensation for loss of his office at a time of life which makes it next to impossible for him to secure another suitable appointment.

That there is little immediate prospect of the Government giving the desired recognition and protection must be admitted, but Mr. Drew suggests that when the war is over an early opportunity should be taken of sending another deputation to interview the Local Government Board on the subject. In the meantime he is of opinion that it is necessary to provide self protection by accepting the offers made to surveyors by the association registered as Official Security, Limited, which offers policies of insurance against loss or diminution of official salary, litigation risks, and larceny of money in transit. There are several other important points raised in the paper, such as the appointment of unqualified and inexperienced men as surveyors, and superannuation. Our own columns have, unfortunately, provided many glaring cases where men with no suitable experience have been appointed surveyors simply owing to having friends or relatives on the council. The veto of the Local Government Board which is now exercised in the case of the appointment of inexperienced men as sanitary inspectors should be extended to surveyors, and this would naturally follow any action they may take to afford surveyors security of tenure. Superannuation is, in Mr. Drew's opinion, not of much use without security of tenure, but once this security is obtained he believes that superannuation would quickly follow.

* * *

Diesel Oil Engines.

The use of internal combustion engines for all branches of municipal work has become very general during the past few years, and therefore the paper on "Diesel Oil Engines," by Mr. F. R. Phipps, which is reproduced elsewhere in this issue, is not only opportune, but a valuable con-

tribution to the literature on the subject. Up to the present time the use of the Diesel engine in this country has been chiefly confined to the generation of electricity, but there does not appear to be any sufficient reason why it should not also have a greatly extended use for pumping plants in connection with sewage and waterworks. The most suitable prime mover to be used can only be arrived at after a very careful consideration of all the factors bearing on the matter. Steam, oil, and gas engines will give very different results so far as working costs are concerned according to the locality in which the engines are erected, and will depend chiefly on the cost of fuel in the various districts. In many cases it is possible to utilise the steam raised by the destruction of refuse for the generation of electricity for lighting, tramways, or pumping, and in these cases there can be little question that steam will be the most economical form of power. Again, where coal is cheap, as in the colliery districts, steam will nearly always beat other competitors. There are, of course, other factors to be taken into account as well as cost of running, such as the size of buildings and æsthetic and hygienic considerations, but speaking generally the running cost is nearly always the deciding factor.

Mr. Phipps gives some very useful figures with regard to the costs of various forms of power, which he obtained before deciding on the form of engines to be used in the electricity scheme he has recently carried out for the Basingstoke Council. Though very different results would bound to obtain in towns near the coalfields, the figures given are still of great interest, and will be very helpful to many surveyors in different parts of the country. Town's gas he dismisses as too costly at 3s. 1½d. per 1,000 cub. ft., as this works out at ·75d. per b.h.p. hour. Producer gas with anthracite at 30s. per ton costs at Basingstoke ·25d. per pump horse power (roughly ·22d. per b.h.p.). Steam with coal at 26s. 6d. per ton costs ·35d. per p.h.p. (·30d. per b.h.p.), while the Diesel engines with oil at 82s. per ton gives a b.h.p. of ·22d. One great objection at the present time to the adoption of the Diesel oil engine is that the crude oil used in these engines has practically gone up in the same ratio as petrol or petroleum, which is in most places much greater than the advance in the price of coal. Mr. Phipps says three years ago he obtained his oil fuel at 45s. per ton; to-day he pays 82s., and has entered into a contract for next year at 146s. 6d., with the important proviso that it is to drop to 50s. per ton six months after peace is declared. The paper touches on many other practical details of working, all of which contribute to the success or otherwise of the Diesel oil engine. Thus he insists on the need of choosing an engine of low speed, with as low a mean effective pressure as possible, of providing a sufficiently firm and massive foundation, so as to avoid vibration, the prevention of nuisances from noise and fumes from the exhaust, the silencing of the air inlet pipe, the adequate lubrication of all parts of the engine, and the arrangement of the engines, cooling, and details of erection. Mr. Phipps is to be congratulated on the very successful working of his electricity scheme, for, despite the fact that the station has only been completed since the war began, and the disadvantage of the high cost of fuel and other increased running expenses which the war has entailed, a nett profit of £325 has been made on the first year's operations.

* * *

Diversion of Highways.

The Act which was recently passed for the purpose of simplifying the language in which criminal indictments are drawn serves as a reminder that there are other directions in which legal reform in the nature of simplification would be welcome, as, for example, in the case of the procedure for securing the diversion or stopping up of an unnecessary highway. At common law a highway which has once been dedicated to the public remains a highway for ever, but this general rule was modified in 1835, when, by the Highway Act, a procedure was laid down by which unnecessary highways could be stopped or diverted. This procedure is in itself by no means simple, and it has been further complicated both by the extraordinary language of one of the sections and by the judicial interpretation of others. Take as an example the simplest possible case—namely, where a highway authority commence proceedings of their own motion. The first step is that they must, "by order in writing, direct the officer whom they appoint to deal with the matter to apply to two justices to view." It has been held that the view of the justices must be a joint one, and further that if two justices view the highway and refuse to make an Order, application may be made to two other justices without any fresh resolution being passed. So far the procedure is at least clear, but the next provision is really difficult to understand. It relates to the giving of notices, if the justices approve of the proposed diversion or stopping up. In such a case the justices shall direct the local authority to affix a notice in the prescribed form "at the place and by the side of each end of the said highway from whence the same is proposed to be diverted or stopped up."

It is hardly surprising that these last words have been the subject of litigation, and they have been interpreted as meaning that the notices are to be put at the side of (and not *in*) the highway at the two ends of the portion to be diverted or stopped up. When the justices are satisfied that the necessary notices have been duly published, and a plan has been delivered to them particularly describing the old and the proposed new highway "by meters, bounds, and admeasurement thereof," they have to certify in writing the result of their view, giving reasons. The certificate and plan are then as soon as possible to be lodged with the clerk of the peace for the county, and, having been kept for four weeks, must be read at the next quarter sessions in open court. Finally, unless any aggrieved person lodges an appeal against the proposal, the documents are enrolled among the records of the Court and the Order for stopping up or diverting the highway is made. We have indicated the procedure in the barest outline. If the highway be situated in a rural parish, the consent of the parish council and of the district council is required for its stopping up or diversion, while in all cases of diversion consent in writing is necessary on the part of the owner of the land through which the diversion is to be made. All this is very complex, at least to the lay mind, and the whole procedure is capable of simplification. After all, a procedure which was adapted to the conditions of almost a hundred years ago is naturally not quite in accordance with modern ideas. Perhaps the matter of the simplification and codification of certain branches of the law may be one of the tasks the Government will be able to take in hand "after the war."

* * *

The Bill for Dublin Rebuilding.

The difficulties of Irish legislation just now have their origin in politico-social movements which need not be enlarged upon here except to say that it would be regrettable if these influences upon one side or another jeopardised the effort on behalf of the reconstruction of Dublin which is being made by the Government. The Bill for this purpose, as it is drafted, makes

provision for the compulsory purchase of land by the Dublin Corporation for the purpose of widening or otherwise improving streets by means of an Order submitted to the Local Government Board, and confirmed by that authority. This is a substitution of the Government department for the procedure under sec. 203 of the Public Health (Ireland) Act, 1878, or any subsequent amendments of this measure. Sec. 41 of the Act is extended so as to enable the corporation to make by-laws "with respect to the structure, materials, design, alignment, and general symmetry of the new buildings." This is, of course, a considerable advance upon the powers given to the corporate authority under the existing law, and it is an essential element of the situation if any concession is to be made, as appears to us highly desirable, to the very general demand for the rebuilding of certain at least of the ruined areas upon improved lines. For the purpose of reconstruction the corporation are authorised to advance money on the security of the ownership of the site of any house or building which has been damaged or destroyed, the advance not to exceed the difference between the amount which the Local Government Board certify to be the total cost of rebuilding or restoration, and the amount of the compensation granted in respect of destruction or damage. These are the main provisions of the Bill, and so far as they go there is little to which exception can be taken. But it may be questioned whether they go far enough in attaining one of the objects in view, which is, we take it, to provide a worthy scheme of reconstruction, and take advantage of what may be termed a unique opportunity. There is, therefore, much cogency in the proposition of Mr. R. M. Butler, of Dublin, that some administrative commission or tribunal, working in harmony with the corporation, should be created to deal with the many problems of practical construction and planning, as well as of beauty and fitness, such as it is hardly possible a municipal council could solve. Some such advisory body would seem to be essential if the best results are to be obtained alike from the architectural and economic points of view.

* * *

The Commercial Value of Improvements.

Attention has been called to the remark made by Mr. John Burns, in the course of the recent discussion on the Bill relating to the strengthening of Charing Cross railway bridge, that "beauty is not only pleasing to the eye and consoling to the mind in a great city; it pays in solid cash." This dictum was made the text of an excellent article by Mr. Ernest Newton, R.A., the president of the Royal Institute of British Architects, in a recent issue of the *Daily Telegraph*. In the course of his article Mr. Newton called attention to the connection which necessarily exists between the corporate life and aspirations of any city and its architecture. An excellent illustration of the truth of this principle is afforded by the magnificent municipal buildings which have been erected all over the country during the last thirty years, a period which has also witnessed an enormous development in municipal life and activity. The improvement of the architecture and planning of a great city are not only worth while on account of their intrinsic value, but also on account of the effect which they have on commercial life. As Mr. Newton said, money which is spent upon well-planned streets and fine buildings is well invested. Our business firms already recognise this. The magnificent and costly premises erected for our big banking and shipping corporations, the luxurious establishments of our great retail houses are witnesses to the value of appearances, the impression produced on the public by a display of solidarity and wealth and the attractiveness of handsome surroundings. It is well that this commercial aspect of municipal improvements should be borne in mind if only for the reason that the cash argument is the only one which appeals to certain minds in connection with improvements that are primarily required in the interests of public health.

* * *

A Tramcar Accident.

In connection with the accident which occurred a short time ago on the Wigan Corporation narrow-gauge tramways an inquest was held last week, and in the course of the inquiry some interesting theories were advanced as to the cause of the accident. Mr. Frank Buckley, the general manager of the corporation tramways, stated that the car was fitted with three brakes—the ordinary hand-brake, a slipper-brake, and an electric brake—and that it had been overhauled the previous day. He further pointed out that after the accident the car ran on the lines and through all the points to the depot without any trouble. The driver of the car advanced the theory that the front wheels jumped the metals at the points, and ran off the lines from the points to a crossing, the back wheels keeping on the track all the time. Upon the car reaching the crossing it tended to turn across the road, and so overturned. Mr. Buckley pointed out, however, that if this theory were correct, and the wheels took the wrong road, any projection getting into the points would stop the point tongue going back into the socket. Apart from some foreign substance getting into the rail, there was, he thought, nothing to account for the car leaving the rails. A juryman asked whether the line would not have been safer either with a broad gauge or with a one-deck car, and in reply it was pointed out that the present system had been approved by the Board of Trade, and so must be presumed to be safe. It was further stated that this was the first car that had overturned in twenty years. The coroner said he had no hesitation in advising the jury that there was no evidence of any criminal neglect, and a verdict of accidental death was returned, the foreman stating that the jury "do not hold anybody responsible for any negligence in any shape or form."

* * *

Appointments During War Time.

We have already drawn attention to the desirability of local authorities as far as possible only filling temporarily appointments in their offices which may fall vacant during the war. The reason for this is two-fold. In the first place, a local authority can hardly expect to get applications in present circumstances from many of the best possible candidates, who are serving their country in the field, and in the second place, if lucrative appointments are now filled, those who have given up so much for the sake of their country will be handicapped and possibly their whole careers affected by being precluded from applying for such appointments. But even while holding these views, we are quite at a loss to understand the attitude of a certain Mr. Bramham, a member of the Wath-upon-Dearne Urban District Council, who objected to the appointment, even temporarily, of the assistant surveyor as surveyor and waterworks engineer, although that gentleman is already in the service of the council and has several times been rejected as unfit for military service. It is satisfactory to observe that Mr. Bramham found himself in a minority of one.

Assistant County Surveyors' Petrol Allowance.—Assistant county surveyors who ride motor-cycles will have their claims for additional petrol considered by the Board of Trade.

Diesel Oil Engines.*

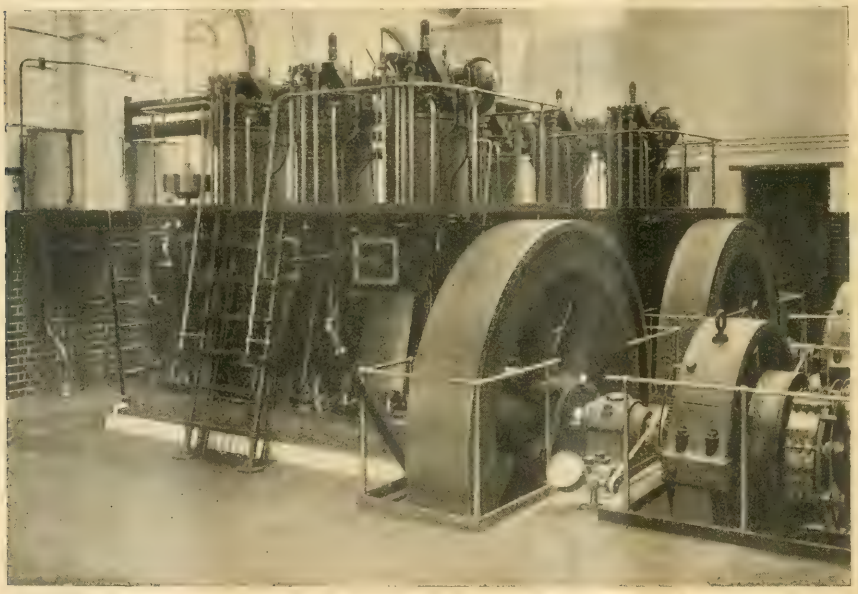
By F. REGINALD PHIPPS, Assoc.M.Inst.C.E., F.S.I., Borough Engineer of Basingstoke.

The use of Diesel engines has of late years come prominently to the front for electric light works, sewage and water pumping, and the author hopes that an account of their use may be welcome and instructive.

Having been instructed by his council to carry out an electric lighting scheme for the town, the question of the most suitable prime mover to be used was one of the most important points to be decided.

The merits of steam, oil and gas engines were carefully considered. Gas engines worked by town gas were, of course, ruled out at once by the high running costs; allowing a consumption of only 20 cub. ft. of town gas per b.h.p. hour, the cost at the local price of 3s. 1½d. per 1,000 cub. ft. would be ·75d. per b.h.p. hour. If producer gas is used, as in some towns, the economy becomes more marked, open to conjecture; but it is apparent that even at 82s. per ton the economy in power production is most marked.

The use of suction-gas engines, however, is limited by other reasons than the question of economy; some of these are—the difficulties of direct driving, and the unsatisfactory nature of belt driving; the tarnishing of electrical instruments and other brass work from the gas fumes; the difficulty of disposal of scrubber water, and the appreciable time required in blowing up the gas before starting. In addition, it is difficult to run on a light load for any considerable period, owing to the cooling of the fuel in the producer; also, should a heavy load be applied suddenly, the speed of the engine tends to drop, as the fuel cannot be made incandescent quickly enough to supply the necessary gas.



Diesel Oil Engines at Basingstoke.

and nearly approaches that of Diesel oil engines. Thus in the waterworks which are worked by suction gas the average yearly cost per pump horse-power hour, with anthracite averaging 30s. per ton, has continued to be about ·25d.

With the Diesel engines, which were decided upon and eventually installed, the cost of fuel per kilowatt-hour, with oil at 82s. per ton, is about ·30d., equivalent to a price per horse-power-hour of actual work of ·22d.

Even allowing for a higher efficiency of engine and dynamo over that of engine and pumps, the advantage in economy is with the oil engine.

Comparison of Cost of Fuel.

When considering these costs the price of fuel must be taken into consideration. Anthracite delivered at the station has varied in the last eight years between 26s. and 32s. per ton, while oil fuel has undergone greater fluctuations. Oil three years ago could be obtained at about 45s. per ton at station; our present contract price to August, 1916, is 82s. per ton, while the high price of 146s. 6d. has had to be paid to secure a contract for delivery in 1917. This is subject to a reduction of 50s. per ton six months after the declaration of peace.

This price is bound to drop considerably after the war, but whether it will ever reach its old low level is

As regards steam, its great advantage is its reliability, but unless large units are being installed, so that superheated steam and turbines can be used, the fuel costs are high in comparison with the Diesel.

For a medium-sized engine, say up to about 150-b.h.p., the consumption of good steam coal per p.h.p.-hour under actual working conditions of electricity supply would not be less than 2½ lb. Such coal now costs here 26s. 6d. per ton at railway, which gives a cost of ·35d. per p.h.p.-hour, or an equivalent of ·47d. per kilowatt-hour.

Beyond the question of fuel costs, the capital expenditure must be considered. With a Diesel engine a considerable saving is made in the cost of buildings by the fact that no boiler-house, chimney shaft or economiser is required. In addition, a large quantity of water is not required for feed and condensing purposes, though a certain amount is required for jacket circulation.

Cost of Machinery.

As regards the capital cost of the machinery, it can generally be taken that the Diesel engine will cost as much as the steam engine and the necessary boiler.

The cost of two 150-b.h.p. Diesel engines, and all requisite accessories, erected in 1914, was £2,762; the water cooler for dealing with 36 gallons per minute was £195, and the softener, of 200 gallons per hour-size, was £63.

* Paper submitted at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

The cost of these engines was very low, and the cost of an exactly similar engine which was added in April, 1915, was £1,739.

After carefully weighing up all the various points, the author decided to recommend the adoption of Diesel engines, and two sets of 150-b.h.p. each, coupled to direct-current dynamos of 100 kilowatts, were installed.

The following fuel guarantees were given with the tender, and have been easily fulfilled on the test and in actual working:—

Full load	·44 lb.	per b.h.p. hour	·68 lb.	per kw. hour.
¾	,, ·47	,,	·70	,, ,,
½	,, ·54	,,	·83	,, ,,
¼	,, ·70	,,	1·18	,, ,,

The engine was also guaranteed to run satisfactorily on an overload of 10 per cent. for two hours.

Before describing the practical points in connection with Diesel engines, the general theoretical principles involved may be considered.

THEORETICAL PRINCIPLES.

The economical working of the Diesel engine is due to the fact that the heat value of the fuel is utilised to a greater extent than in any other prime mover.

Thus the Diesel engines consume per b.h.p.-hour about 7,500 b.t.u.

Gas engines consume per b.h.p.-hour about 9,000 to 12,000 b.t.u.

Steam engines consume per b.h.p.-hour about 16,000 to 28,000 b.t.u.

This high efficiency is due in the first place theoretically to the fact that the range between the high temperature of the ignited fuel and the low temperature of the exhaust is very great.

The efficiency formula for the Carnot perfect engine cycle is—

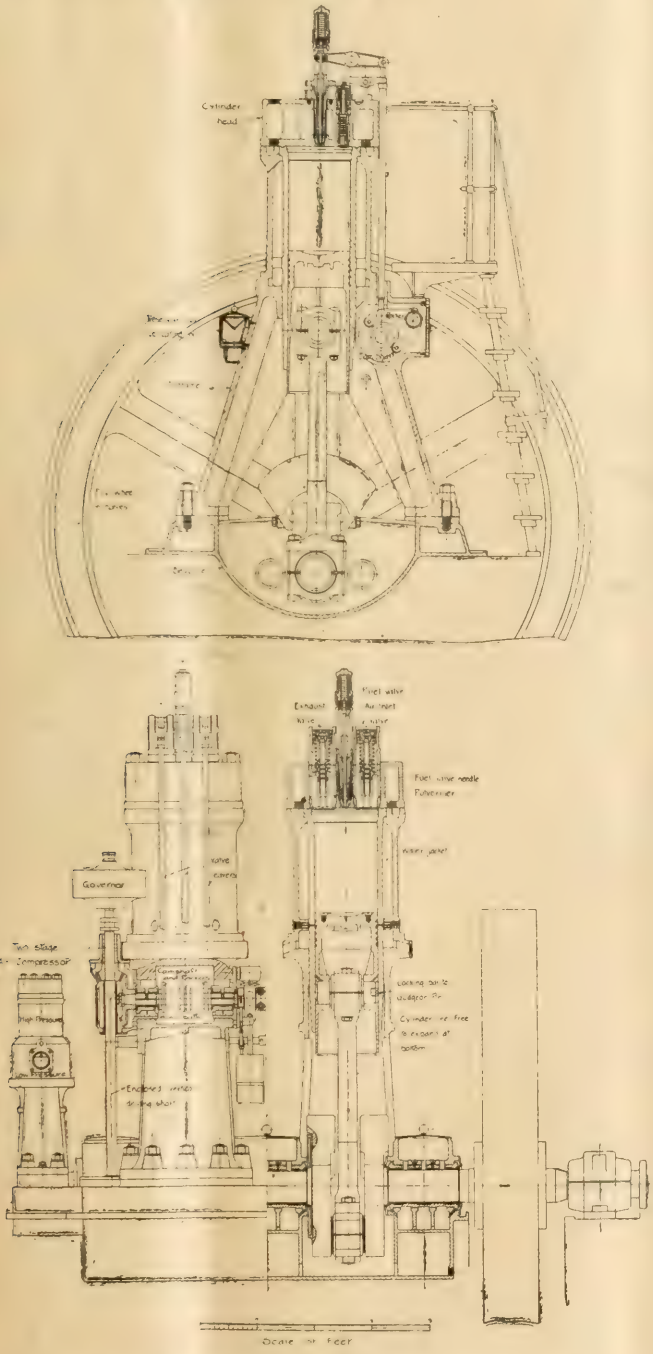
$$\frac{\text{work done}}{\text{heat expanded}} \qquad \frac{T_1 - T_2}{T_1}$$

T_1 being the initial absolute temperature of the gas, and T_2 being the final absolute temperature of the gas.

Practically, also, the Diesel works with such high compression that the clearance space is very small, so that there is very little surface for cooling the gases when they are at their highest temperature—*i.e.*, on ignition of the fuel.

There are no losses from boiler or producer plant, and less loss in cooling or condensing water; also fuel is only being consumed during actual running, there being no standby losses as in steam or producer gas. In addition, any class of liquid fuel can be used, from petroleum to tar oils; that generally in use is the thick heavy residual oil which is left after the lighter oils—petrol and petroleum—have been distilled off from the original crude oil. This fuel oil has a specific gravity of about ·92-·95, and a heat value of about 18,000 b.t.u. per lb. It has a high-flash point of about 200 deg. Fahr., so that there is little risk of fire in storage or use.

Owing to the present high price of fuel oil, the use of tar oils is likely to come prominently forward in the near future. These tar oils are the heavy oils (creosote and anthracene) which are obtained in the fractionation of coal tar after the lighter oils



Diesel Oil Engines: Section of Single Line Set of 50-h.p.

(benzol, phenol, &c.) have been distilled off. They are also a by-product from coke ovens, which it is becoming increasingly remunerative to recover. The specific gravity is from 1·0 to 1·10, and the heat value is about 15,800 b.t.u. per lb. They cannot, however, except at high loads, be used without an auxiliary, which takes the form of a pump which delivers a very small quantity of easily burning oil, such as paraffin, into the cylinder to start the ignition of the tar oil. More frequent attention to the valves is also required, as they are more liable to clog and stick up than if a cleaner fuel oil were used.

The outstanding and distinguishing feature of the Diesel engine is that ignition is not obtained by any external agency, such as sparking plugs, lamps, &c., but by high compression generating sufficient heat to ignite the fuel mixture. The majority of Diesel engines in this country, and especially the smaller sizes, are single acting and of the four-cycle type, the sequence of which is shown in Fig. 1.

On the first and outgoing stroke of the piston air is drawn into the cylinder through the air valve.

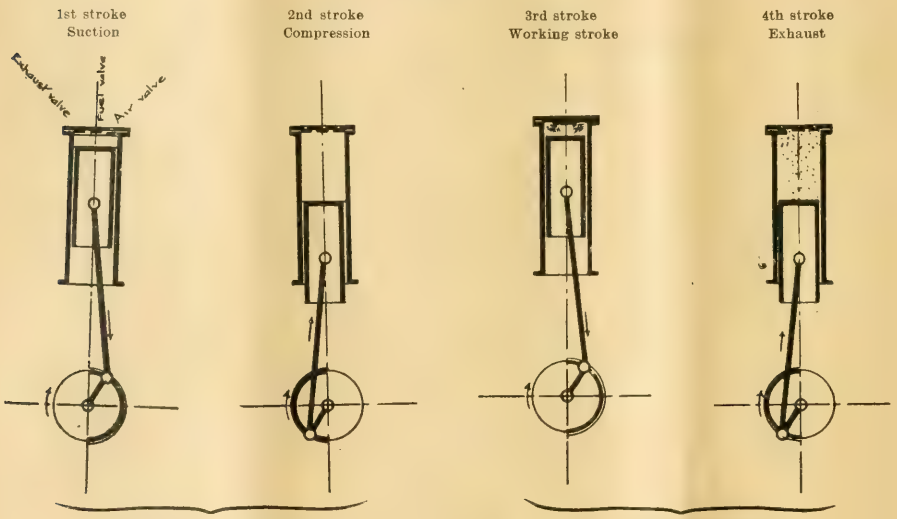


Fig. 1.

On the second and return stroke all valves are closed and the air within the cylinder is highly compressed, usually to about 450 to 500 lb. per square inch, with an accompanying increase of temperature to about 1,000 deg. Fahr. On the third stroke the fuel valve opens, and the fuel which has been accumulated in the passages of the fuel valve is blown through a pulveriser into the cylinder by compressed air, stored at a pressure greater than that in the cylinder. This process mixes the injection air and the oil intimately, so that when it reaches the cylinder it is in the form of a spray. Directly this spray enters into the highly compressed and heated air it automatically burns, increasing in volume and driving the piston down. This, therefore, constitutes the power stroke of the cycle. It will be seen that no explosion takes place in the true sense of the word, and this type of oil engine therefore works much more quietly than any other type of internal combustion engine. On the fourth stroke the burnt gases are exhausted into the atmosphere, and the cycle is then repeated.

The corresponding indicator diagram is shown in Fig. 2.

In this cycle there are, of course, two revolutions of the crankshaft for one working stroke.

In the two-cycle type of engine there is only one revolution for each working stroke. This is shown in Fig. 3, from which it will be seen that the exhaust is taken through ports in the body of the cylinder, and not in the head. A special scavenging pump is also required for the removal of the exhaust gases, and for filling the cylinder with fresh air. On the first portion of the ingoing stroke of the piston the exhaust gases are scavenged out of the cylinder and replaced with fresh air; on the second portion of the same stroke the air is compressed. At the commencement of the second stroke the fuel oil is injected and ignited, thus constituting the working stroke; near the end of this second stroke the exhaust gases are allowed to escape, and then a fresh cycle commences.

The indicator diagram, Fig. 4, is similar to the preceding one, except for the sudden drop of pressure near the end of the working stroke.

PRACTICAL CONSIDERATIONS.

In the author's opinion two of the most important points to be borne in mind in choosing a Diesel engine are to obtain as low a speed and as low a mean effective pressure (m.e.p.) as possible. The cylinder heads and pistons are subjected to such great pressures and temperatures that any reduction of these, while still obtaining the same power, is most beneficial. The continual heating and cooling induces fatigue of the metal, and the more rapid

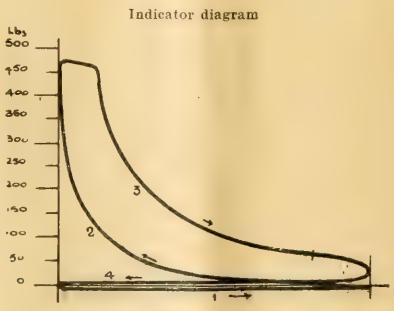


Fig. 2.

these alternations are the quicker the fatigue. A slow speed is therefore of great value in reducing the trouble often met with in high-speed oil engines of cracked heads and pistons.

The m.e.p. is obtained as follows, the actual dimensions of the engines installed being taken:—

A mechanical efficiency of 75 per cent is usually assumed; therefore a b.h.p. of 50 is equivalent to an i.h.p. of 66⅔

Diameter of cylinder 13 in.

Area of piston 132·73 sq. in.

Stroke 20 in.

Number of revolutions per minute 210.

Then $\frac{\text{PLAN}}{2} = 66\frac{2}{3}$

Therefore $\frac{P \times 1{\cdot}66 \times 132{\cdot}73 \times 210}{2 \times 33{,}000} = 66\frac{2}{3}$

Therefore P = $94\frac{1}{2}$ lb. per sq. in. = M.E.P.

The largest maker of Diesels on the Continent quoted for an engine of this size, having a speed of 195 r.p.m., with an m.e.p. of 96·1, while that quoted by probably the largest maker in England had a speed of 250 r.p.m., with a m.e.p. of 102½.

A further point requiring attention when installing Diesels is that great care is necessary in providing a sufficiently firm and massive foundation for the engine, so as to prevent trouble from vibration. A peculiarity of this vibration seems to be that it is not very noticeable in the engine-house itself, but is more pronounced some distance away. Trouble has arisen in various towns from this cause, and an injunction has been obtained against a neighbouring council at the instance of an aggrieved householder living near a Diesel engine station.

tion obtained by drawing air from inside the engine-house might be an advantage.

In actual running special care is required to see that the lubrication of all parts is adequate. Failure in this direction has been the cause in many cases of melting of the white metal of the bottom bearings, and in some cases this has been followed by fracture of the crankshaft—an expensive item to replace.

Other results often due to faulty lubrication are seized and cracked pistons, though the latter more often is caused by running the engine for long periods on overload and at high speeds. Many engineers on this account hesitate to put their engines for long runs on more than 90 per cent of their rated capacity, and if this is necessary it should be taken into account in the comparison of capital costs.

ARRANGEMENT OF ENGINES.

The general arrangement of Diesel engines is that of having one, two, three or four cylinders in a line, the power of these cylinders varying as desired. Few English makers go beyond 125 h.p. per cylinder, and

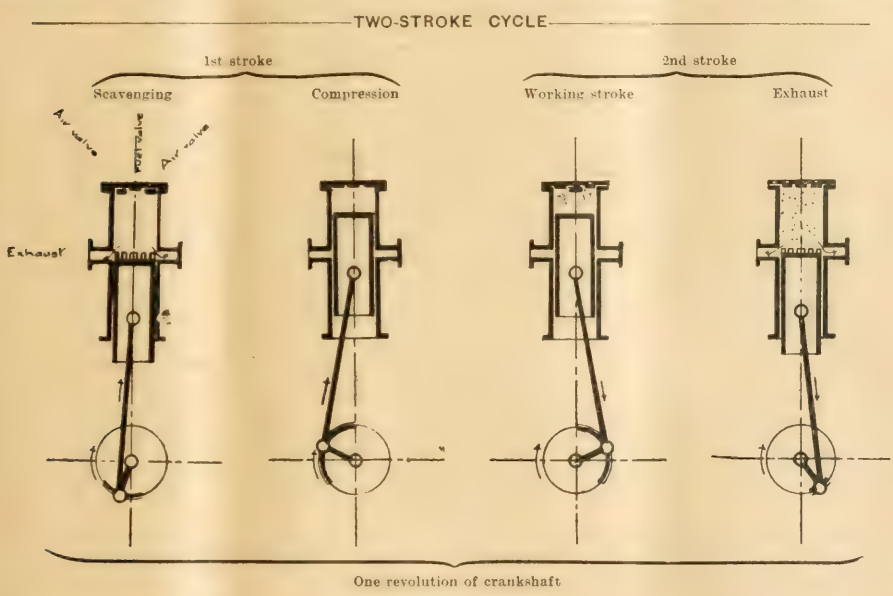


FIG. 3.

In the majority of stations nothing more appears to be done than to provide a massive foundation of rich concrete carried down on to a solid bearing. In one or two instances a cushion of a few inches of sand has been interposed between the base of the concrete and the substratum. A space has also in some cases been left round the sides and ends of the concrete so that no vibration should be transmitted to the adjoining earth. Several patent methods of combating this trouble are also in vogue, comprising chiefly the use of cork layers to surround the foundation concrete.

In the author's case a plain 5 to 1 concrete foundation was used, carried down to a depth of 7 ft. on to a solid chalk foundation, and no trouble has yet been experienced.

Nuisance is also occasionally caused by noise and fumes from the exhaust, and noise from the air-inlet pipe. A quiet exhaust can, however, generally be obtained by providing an underground baffle pit, from the end of which the vertical exhaust pipe is carried up to the roof of the building, and capped with a cast-iron silencer. A smoky exhaust should never occur if the valves are in correct adjustment, except possibly for a few moments at starting.

The air inlet pipe requires silencing, and this is usually done by closing the end of the pipe, and providing a series of long, narrow slits in lieu of the open end. If the air-inlet pipe is carried outside into the open, a quieter engine-house is the result, and the air obtained is certainly no less suitable for combustion purposes than that inside. On the other hand, in a confined engine-house the ventila-

Indicator diagram

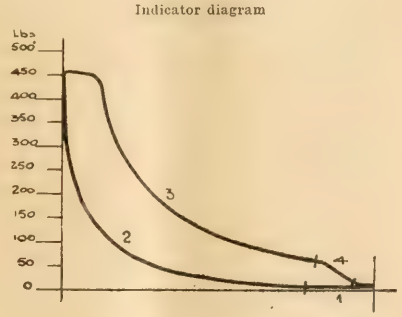


FIG. 4.

the Basingstoke set, which was manufactured by Messrs. Cole, Marchent & Morley, of Bradford, is a three-line set of 50 b.h.p. each. Sections of a one-line set are shown.

The cylinders are carried in the usual "A" frame, which is in its turn bolted on to the bed-plate; the latter is secured by 2-in. holding-down bolts, going 5 ft. down into the concrete foundation, finishing with 9-in. plates, the whole as usual being grouted up with cement.

On top of the cylinders are bolted the cylinder heads, on which are fitted the fuel valve in the centre,

with the starting valve in front, and the exhaust and air inlet valves on either side. These valves are actuated by three outside levers, worked from a camshaft supported on the "A" frame; in most cases the valves are driven direct from the camshaft without the intervention of levers, but it is claimed that the former has an advantage by simplifying the casting of the cylinder heads and "A" frames in doing away with the projections to carry the camshaft bearings; also that the starting gear can be more easily operated from the ground, and again that it makes it possible to enclose the whole of the cams and rollers in an oil bath, so reducing wear and noise.

The camshaft is operated from the crankshaft by a vertical driving shaft, fitted with skew and bevel gearing. The same shaft also drives the governor, which controls the speed of the engine in a very sensitive manner. Each cylinder has its own fuel pump driven by an eccentric from the camshaft, and the governor acts by limiting the amount of fuel oil delivered by this pump. It does this by controlling the suction valve. When the speed increases, a tappet underneath the valve is lifted by the governor, the period of lift varying with the speed. Thus, with a full load and normal speed, the tappet does not touch the suction valve, but if the load is lightened and the speed automatically goes up, the suction valve is proportionately held up during part or the whole of the suction and delivery strokes, thus limiting the amount of fuel oil reaching the cylinder.

The fuel pump is also provided with a by-pass, which allows the pipes to the fuel valve to be charged with fuel by means of a hand pump, so as to facilitate starting up.

The camshaft also operates a lubricating pump, which forces the oil round the cylinder walls, and also to the gudgeon pin of the piston. This oil is supplied by drip feed from an oil reservoir bolted on to the standards, another drop from the same reservoir going direct to the centrifugal oiler bolted on to the crank for lubricating the big ends of the connecting rod. The main and camshaft bearings are ring-oiled, and fitted with inspection covers for maintaining the proper oil level.

The air compressor is driven off the extreme end of the crankshaft, and supplies air to the starting and running cylinders or bottles. It is of the two-stage type, the bottom low-pressure piston compressing up to a maximum of 100 lb. per square inch, and the top high-pressure piston raising this to the blast pressure required, a maximum of about 750 lb. The compressor is water-cooled in the usual way.

The compressor delivers to two large bottles, the air from which is used for starting up the engine, and also to one small bottle for supplying the air for blowing in the fuel oil. The bottles are usually of welded steel, and are tested to 2,000 lb. per square inch. Three pressure gauges are provided, giving the pressures in the intercooler, the starting bottles, and the running bottle.

After the engine has been started up, the throttle valve on the low-pressure side is opened fully, so as to restore the full pressure to the starting bottles, and it is then adjusted to maintain the correct pressure in the running bottle.

The fly-wheel is of massive proportions, being 8 ft. 6 in. diameter and 7½ tons in weight, and is in halves. It ensures very steady running, the cyclical variation being 1/150.

The fuel oil is stored in a large cylindrical iron shell outside, holding about 23 tons. It is pumped thence by hand to the daily service tank in the engine-house, holding 200 gallons, and gravitates from this to the filter tank, which strains out any thick matter which would clog the pipes.

A second filter tank is also provided for the storage of gas oil or paraffin, and the engine is run from this for starting up, and for about five minutes before shutting down, in order to leave the valves, &c., in a cleaner condition. A three-way cock allows either oil to be used as required. The oil gravitates to the fuel pump, and thence is delivered to the fuel valve, situate on the top and in the centre of the cylinder cover. Inside the fuel valve is a pulveriser, which consists of several brass plates with small holes through which the oil is forced, thus dividing it into a fine spray. This spray of oil is forced into the cylinder by the blast of compressed air from the running bottle.

The amount of compression in the cylinder at the moment the fuel is injected is constant, and generally averages about 450 lb. per square inch, but this can be varied to suit the particular type of oil used. The running-bottle pressure varies according to the load from 550 lb. to 750 lb. per square inch.

COOLING.

A water-jacket having a 2-in. water space surrounds the cylinders, and the flow of water should be sufficient to keep the temperature of the outlet water below 140 deg. Fahr.

It is essential that the jacket space should be kept free from scale or deposit, and the circulating water must therefore be soft and clean. The town water is used in this case, and as the hardness is 15 deg., of which 11 deg. are temporary, it is softened before use. If the cooling water is supplied at a temperature of 60 deg. Fahr., and the outlet does not exceed 140 deg. Fahr., about 6 gallons per b.h.p. hour are required. Unless, therefore, suitable water can be obtained from a canal or stream, the cost of the circulating water would be a considerable item. To reduce this, a Heenan & Froude's cooler has been installed, by which the actual amount of water wasted is reduced to 2½ per cent of the above figure; the actual amount of water required for the generation of 200,000 units was 39,000 gallons; the cooler is compact and economical, and can deal with 36 gallons per minute.

The gearing and pump are actuated by a 5-h.p. motor, and 3 units an hour are used with both engines running. At "works cost" price the current used costs 3d. per hour.

The cooler comprises a circular drum containing galvanised steel sheeting wound in a spiral, which dips for about a third of its depth into a receiver, and is revolved through gearing from the motor. The exhaust water gravitates to the receiver, and is picked up by the slowly revolving plates. A current of air is drawn through these plates by means of a fan, and the resultant evaporation of the thin film of water picked up produces a considerable cooling action by the abstraction of the necessary latent heat from the plates, in addition to the cooling due to the contact of the air and water. The cooled water is taken from the other end of the receiver and is lifted to an overhead storage tank by a centrifugal pump. This water is then ready once more to circulate through the water-jackets. The only make-up water, therefore, required is to replace that evaporated, and only this small quantity requires softening.

Dealing as we are with comparatively high speed and considerable pressures, the liability to accidents is probably greater than with steam, but, given a well-designed Diesel of adequate strength to withstand the stresses set up, these accidents should be few and not of serious character. The economy in fuel is undoubted, and ought to outweigh the attendant disadvantages.

COST OF WORKING.

The works since completion in October, 1914, have been under the able management of Mr. George Broadhurst, A.M.I.E.E., who, having previously acted as clerk of works during construction, was appointed electrical engineer, and so successful have they been that a third engine of similar size, and from the same makers, had to be put down last summer.

The financial results have also been most satisfactory, the following being the figures for the year ending March 31, 1916:—

Earnings		£3,212
Expenditure—Working costs ...	£1,725	
Loan charges ...	1,162	
		2,887
Net profit		£325

Units sold, 406,465. Load factor, 22·4 per cent.

Total costs per unit *sold*.

Working costs—Fuel oil	·33d.
Oil, waste, water and stores	·05d.
Wages	·18d.
Repairs and maintenance ...	·14d.
Rates and taxes	·04d.
Management, salaries, insurance, &c.	·27d.
	1·01d.
Loan charges, interest and redemption ...	·68d.
Total cost ...	1·69d.

It is very rarely that a small town can show a nett profit in the first year of an electrical undertaking, and this fact and the lowness of the working costs per unit sold are a great testimony to the efficiency of the Diesel engine. The attention of municipal engineers might usefully be turned more closely to this source of power in the future when considering the installation of water and sewage pumping machinery.

Surveyors: Their Security of Tenure and Defence—(2).*

By J. H. DREW, M.Inst.C.E.I., Borough Surveyor of Grantham.

Members are told from time to time that in regard to security of tenure and superannuation, the council of the institution are in close co-operation and consultation with the National Association of Local Government Officers, who have the same objects in view. The council, the author believes, fully realise how necessary it is to take any opportunity towards obtaining security of tenure for the members, who have often very difficult and trying positions to fill. The author fully appreciates the work being done by the National Association of Local Government Officers, but is it not a case for considerably more self-effort? Does not the duty of helping one's self in the highest sense involve the helping of one's neighbour?

Union is strength, and if the majority of the members would band together in some scheme, or join the excellent association founded by Official Security, Limited, to insure themselves against loss of office, and for the purpose of defence against libellous, slanderous or other illegal attacks, it would no doubt help any deputation to prove to the Local Government Board that they were helping themselves to defend their positions, although, having to administer the laws and regulations issued by the State, they nevertheless consider the necessary protection in our offices should be provided impartially.

Although up to the present the results achieved have been *nil*, three Presidents of the Local Government Board have been petitioned and interviewed upon this question of security of tenure first at the initiation of the institution in 1872, again in 1884, and lastly in February, 1914, when Mr. John Burns held office.

It will be observed that a period of thirty years elapsed between the second and third deputations, but one hopes that a recent prediction in one of the leading technical journals to the effect that surveyors are likely to be still clamouring twenty-five years hence for protection will prove very wide of the mark, and that long before then their efforts will be rewarded by success.

Mr. Herbert Samuel, when President of the Local Government Board in 1915, was the first president to concede the principle of security of tenure to whole-time medical officers of health and inspectors of nuisances, and in that decision the present president, Mr. Walter Long, in a letter to Sir Philip Magnus, M.P., on December 30, 1915, stated that he entirely agreed with the decision at which Mr. Samuel arrived and that he was strongly in favour of security of tenure for these officers.

As members are aware, an order has now been prepared to give security of tenure to whole-time medical officers of health and inspectors of nuisances, but the steps towards this were well ahead before war broke out, although the issue of the order has, unfortunately, had to be postponed until the conclusion of the war.

The author appeals to the council, particularly on behalf of the surveyors to smaller districts, to take the first favourable opportunity again to interview the Local Government Board and press the case for security of tenure, and if possible to obtain the inclusion of surveyors in the order dealing with the appointments of the health officers previously mentioned. The author appreciates that the great congestion of work at the Local Government Board and the preoccupation of the president and his chief officials with problems connected with the war will not permit of a petition being presented until the return of normal times and peace has been declared.

POSITION REMAINS AS IN 1872.

The fact must be faced. The position of surveyors appointed under the Public Health Act, 1875, in regard to security of tenure is to-day exactly as it was in 1872, or forty-four years ago. What is the cause? Is it inertia on the part of surveyors themselves? The author rather thinks that has been a great factor in the non-success of previous efforts. What has been achieved for medical officers of health and inspectors of nuisances should not be beyond achievement by surveyors. For a period of thirty years between 1884 and 1914 no official deputation from the Institution of Municipal and County Engineers waited upon the Local Government Board to put forward claims for security of tenure.

SECURITY OF TENURE AND QUALIFICATIONS OF SURVEYORS IN IRELAND AND AUSTRALIA.

Mr. P. C. Cowan, D.Sc., M.Inst.C.E. (honorary member of the Institution of Municipal and County Engineers), the chief engineering inspector of the Local Government Board of Ireland, in an extremely able and thoughtful address to a conference of engineers and surveyors at the Royal Sanitary Institute Congress at Belfast in July, 1911, pointed out that in some respects the law in force in Ireland is more favourable to engineers and surveyors than the corresponding statutes in England and Wales. County surveyors, assistant county surveyors, and practically all town surveyors, as well as sanitary officers, have security of tenure in Ireland, and can only be removed from office with the consent of the Local Government Board of Ireland, which is a separate department from the Local Government Board in England.

Mr. Cowan stated that, in his opinion, this provision has proved very beneficial, and though now and then a tactless officer may presume too far on the protection the law affords him, the control of the authorities over their servants is not unduly affected.

Sec. 27 of the Labourers (Ireland) Act, 1906, enacts as follows: "Every person whom a district council propose to employ as architect, engineer, surveyor, or clerk of works, for the purpose of the Labourers Acts, shall satisfy the Local Government Board that he has sufficient knowledge and experience for such employment."

It can truthfully be said that the thin end of the wedge has been inserted by the provisions of this Act to the securing of only properly qualified persons for such appointments.

The Act further empowered the Local Government Board to make rules and regulations, and a General Order of 1906 states: The following persons shall be deemed eligible for employment as architect, engineer, or surveyor:—

(*a*) Fellows, members, associate members, or professional associates of any recognised professional association or institution of architects or civil engineers, who have been in practice for at least two years.

(*b*) County surveyors.

(*c*) Persons who have a diploma or degree in engineering from a university or college of science in the United Kingdom, and have had two years' experience on works.

(*d*) Assistant county surveyors who are certified by a county surveyor to be possessed of a sound knowledge of building construction.

(*e*) Persons who have been trained for not less than four years in the office of an architect or civil engineer, in good practice, and have had responsible care of works of importance.

(*f*) Persons who by examination, or the production of testimonials or other evidence, can satisfy the board that they have sufficient knowledge and experience for such employment.

Recently the Local Government Minister of the Commonwealth of Australia has assented to a proposition that municipalities having a revenue of not less than £10,000, and that of shires having revenues of not less than £5,000, shall be compelled to employ duly qualified engineers.

The author submits that in the precedents established in Ireland and Australia is the nucleus upon which the Institution of Municipal and County Engineers, in conjunction with other recognised professional associations or institutions if necessary, should again approach the Local Government Board or Parliament, in an earnest endeavour to obtain security of tenure, and the future appointment to the position of engineer or surveyor of persons possessing at least such minimum qualifications as may be prescribed by the Local Government Board in a General Order.

APPOINTMENT OF COMMITTEE SUGGESTED.

The author may perhaps be excused in his zeal

*From a paper submitted at the annual meeting of the Institution of Municipal and County Engineers.

if he suggests to the council of the institution the immediate formation, from among the members of the council (or any other member whom the council may decide to co-opt), of a strong committee to deal specially with security of tenure and the consideration of a scheme to submit to the Local Government Board dealing with the problem in a satisfactory manner to all concerned. The author may be told that such a course has been adopted, but if so, the censor must have prevented the proceedings becoming known to the majority of our members. This committee could put the case before the Local Government Board, and at the same time collaborate with the National Association of Local Government Officers or any other institution or institutions having the same objects in view.

Once security of tenure becomes an accomplished fact, there is no reason to doubt that superannuation will, in due course, quickly follow. Without security of tenure, superannuation, in the opinion of the author, is of little moment.

(To be concluded.)

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Batley T.C.—£25,000 for the extension of the gas-works.

Cumberland C.C.—£1,200 in respect of the rebuilding of Esk Bridge.

Leyland U.D.C.—£6,900 for a new water main.

LOANS SANCTIONED.

Battersea B.C.—£3,728 for electric supply purposes.

Royton U.D.C.—£8,729 for sewerage works at High Crompton.

Crompton U.D.C.—£8,729 for sewerage works at High Crompton.

Derby T.C.—£9,000 for electric mains and motors.

Loughborough T.C.—£700 for electric cable extension.

Newhaven R.D.C.—£4,050 towards the cost of the Newhaven to Seaford road scheme.

Stafford T.C.—£6,280 for the provision of a 500-kw. turbo-generator.

FORTHCOMING INQUIRIES.

AUGUST.

	£
15.—**Porthcawl.** For works of sewerage (Mr. P. M. Crosthwaite)	1,790

SEPTEMBER.

Town Planning.	£
13.—**Neath.** (Mr. George L. Pepler)	—

A Useful Book for Road Engineers.—There is, we understand, a large and increasing demand for the late Mr. John Hutchinson's excellent little work, "The Testing of Tars and Pitches for Roads: A Practical Guide for Engineers and Surveyors." The price of the book is 1s. 7d., post free.

Wood Blocks at War Prices.—On Monday, of four tenders received by Hampton Wick Urban District Council for the supply of 5,000 wood blocks, the lowest, that of Sir W. Burnett & Co., Millwall, at £15 12s. 6d. per thousand, was accepted. Under the previous order the price was only £10 4s. 6d. per thousand.

Decimal Coinage and Metric System.—The President of the Board of Trade was asked in the House of Commons whether the introduction of decimal coinage and the metric system was under the contemplation of the board; and whether in view of the advantage to the internal and external trade of the country, he would consider the appointment of a committee to inquire into the matter and make recommendations. In reply, Mr. Harcourt pointed out that the use of the metric system of weights and measures had been lawful since the passing of the Weights and Measures (Metric System) Act, 1897. Its compulsory use was not under contemplation by the Board of Trade, and he doubted the desirability of appointing a committee with special reference to the question. The introduction of a system of decimal coinage was primarily a matter for the Treasury.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάντ' ὁρᾷ.
(One man does not see everything.)
—Euripides.

SURVEYORS' PETROL ALLOWANCES.

To the Editor of The Surveyor.

Sir,—I was much interested in the Minute on "Surveyors and Petrol" in your issue of 28th ult. I quite expected to find in your last issue a great many complaints from other afflicted souls, and am much surprised that no one "has lifted up his voice." Here is my tale of woe: I am surveyor (unassisted) of a district the area of which is 359 square miles, and my annual mileage on duty for several years back averages 6,000. Several of my journeys "out" exceed 20 miles, while one is actually 35 from my office, and to discharge duties which involve 6,000 miles travelling per annum I am allowed 2 gallons per week (I asked for 18 gallons per month, instead of 25), which at 20 miles to the gallon gives 2,080 in the year. If I make any journey exceeding 20 miles "out" I cannot complete the return run on a week's supply, and when, as I frequently have, and must continue to do, make the 35-mile run "out," my week's supply is exhausted before I am 6 miles on the way homeward. There is no railway in my district, and no other means of travel by which my duties can be efficiently carried out. I am working with a much depleted staff, part of it engaged on work for which Government grants have been received. I am asked to exercise the most rigid economy, which means increased supervision, and all this is to be done on 2 gallons per week. How is it to be done? Who is responsible for this muddle? Who is to help to straighten out the tangle? (I should like to make it clear that the muddle will pay me, as my travelling allowance, small as it is, will be paid in full, whether I complete my 6,000 miles this year or not. I mention this to show that the petrol is not for "joy riding," and that the less I have to pay for the less I will have to pay out for petrol from my allowance.)

Now for the other side. We all know the story of the transport man who washes his car in petrol, and of the airman who always pours out whatever remains in the can rather than carry it back a few yards to the store—both perfectly true, I believe—and also the other of the engines left running at the door of the "White Hart" for several hours while the drivers slake their thirsts within. Leave these out of count. I take only those round me here. Every pleasure car I know of has got a vastly greater supply than has been allocated to me, while one enterprising gentleman who has never had a car has applied for and been granted a licence for a very ample quantity which he may use in the car he has been "talking" of purchasing for the last six years, and which, when, if ever it does arrive, will be used solely for pleasure. To crown it all, though this wonderful committee have got my money I have not yet got my licence. At this very moment I ought to be far from home, but my tank is dry and I can neither beg, borrow, nor steal the precious spirit. Meantime we may have another cloudburst and have all traffic dislocated, and I can do nothing to carry out the necessary repairs. Cloudbursts have been rather frequent of late.—Yours, &c.,

A County Road Surveyor.

August 7, 1916.

The Building Restrictions.—The Ministry of Munitions calls attention to the Order in Council issued on July 20th, which makes it necessary for a licence to be procured for works of construction of various kinds to be proceeded with or commenced. Provided that a licence has been applied for, any building which was actually in progress before July 20th may be continued until a licence has either been granted or refused. Therefore it is not necessary to stop work while the granting of a licence is being considered.

Manchester Corporation and Enlisted Men.—A conference of Manchester Corporation committees and departmental managers has agreed that each department should do its best to find work for returned soldiers. In cases where the men are fit and in good health the places they left for the war will be restored to them without question; for men who have been disabled in any way the departments will find suitable work, and Manchester men, on discharge from the Army, will have preference over all others for any vacant places under the corporation.

The Surveyor
And Municipal and County Engineer.

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THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Were the Westminster City Council justified in withdrawing their support of the Metropolitan Paving Committee, and has the work of this committee been sufficiently useful to warrant the expenditure of £100 a year in obtaining the reports and statistics which have been annually published? Will the eight out of the nine Metropolitan "paving authorities" which have hitherto supported this committee carry on the work without the aid of Westminster, or will the committee feel that their past useful work may now come to an end, especially during the altered conditions due to the war?

* * * *

Is it a fact that a company has been formed to manufacture sanitary pipes and paving flags out of molten lava, as it issues from a certain volcano "somewhere abroad," at a temperature of about 1,500 deg. Fahr.? Have we not heard that a certain hot locality is paved with good intentions, and, if this is so, should not the proposal go one better than good intentions and produce a really first-class paving?

* * * *

Is it a fact that a German society, called the "Friends of Cremation," has lately been founded, and that they have made representations to their Government with a view to the systematic and wholesale cremation of corpses in the battlefields? Will the complete adoption of such a system for soldiers assist the general movement of cremation on sanitary and other grounds, or will the suggestion appear to be repellent to the friends or relatives of men who have died for their country—whether that country was in the wrong or not?

* * * *

Was not the paper submitted to the annual meeting at Blackpool by Mr. W. H. Schofield, the county surveyor of Lancashire, prophetic of the vastly increased and altered character of the traffic which our roads will have to bear in the near future? Is it not evident that manufacturers and others will make less and less use of the railways for conveyance of their goods and resort more and more to conveyance by road? As this becomes evident will it not be necessary to build up certain roads to withstand this traffic, and will not the best granite setts laid on a reinforced-concrete foundation, be the road of the future in and near our large industrial centres? What other description of road is going to stand the traffic without constant and costly repairs?

* * * *

Where would our railroads have been now if the railway directors and their engineers had not foreseen the growth of the weights and speeds which the rails were destined to carry, and what is going to happen if our local authorities and their surveyors do not realise what is in store for the highway of the future?

* * * *

Are not the Torquay Town Council acting patriotically with regard to national afforestation by proposing to plant out with trees another 40 acres of their water-gathering ground? Is it not also good to read that, whereas in 1899 there were only about 11 acres so planted, there are now nearly 183 acres of forest trees? As, however, it is well-known that the planting of trees on gathering grounds sometimes seriously affects the quantity of the run-off of water from a gathering ground, is it not to be hoped that the water engineer has considered this question before planting more trees?

* * * *

Why is the Poole Town Council so averse to the erection of huts at Sandbacks, within their jurisdiction? Why should not people, if they prefer it, live in huts temporarily and enjoy the "natural life," if these huts are not insanitary and are provided with a proper water supply and arrangements for getting rid of the occupiers' "waste products"; and was there any sound argument in one of the councillor's statement that it was unfair to put up these small huts alongside substantial property which had cost £500 or £600?

* * * *

How is the surveyor of Ham, Surrey, going to solve the problem of altering Ham Common so that it shall be isolated in squares, to prevent the spread of fire, and at the same time avoid the chess-board appearance which one of the members of the council feared? Has any other surveyor in this country grappled with a similar problem?

SOMERSET ROADS.

A DIFFICULT YEAR.

Mr. E. J. Stead, the county surveyor of Somerset, is on military service, and the customary annual report on the maintenance and repair of the county roads and bridges is issued this year over the name of Mr. Gordon R. Folland, the acting official.

Mr. Folland states that the period covered by his report has proved a very difficult one in regard to road maintenance, and he anticipates that the ensuing year will prove even more difficult. On the whole, the roads have been maintained in a satisfactory manner, but the effects of the shortage of labour and materials are becoming apparent.

The audited expenditure for the maintenance and repair of the rural main roads for the year 1914-15 (exclusive of establishment charges and improvements) was £93,501, or £107·53 per mile. The estimated expenditure for 1915-16, which Mr. Folland's report covers, was £79,692, a rate of £91·39 per mile.

Only improvements of an urgent character were carried out during the year. The total area of main roads covered, coated, was 999,004 super. yds., with an approximate length of 104·4 miles.

In regard to urban main roads, Mr. Folland states that the audited and allowed expenditure (exclusive of improvements and establishment charges) for 1915-16 was £12,410, which, based on 81·59 miles, averages a rate of £152·102 per mile. The expenditure was £5,031 below the amount of the estimates. The estimated expenditure for 1916-17 is £17,315.

No grants were made during the year towards improvements of a special nature.

SURFACE TARRING.

The estimate for the treatment of an area of 1,732,538 super. yds. was £11,445, being an average rate of 1·58d. per super. yd. The Road Board made a grant of £1,500, based on this estimate. The total length of roads treated was 256,847 yds., with an area of 1,677,841 super. yds. The actual expenditure was £10,715, being an average rate of 1·53 per super. yd. As this expenditure was below the estimate on which the Road Board based their grant of £1,500, the latter was reduced proportionately to £1,404.

Ealing's War Allowances.—Ealing Town Council expenditure in respect of salaries and wages of its staff and employees serving in the Army and Navy has reached a total of £10,946.

Sewage Disposal at Caerphilly.

COMPLETION AND OPENING OF NEW WORKS.

The Caerphilly Urban District Council's consulting engineers, Messrs. Willcox & Raikes, Birmingham, having recently reported the completion of the new scheme of sewerage and sewage disposal for the populous parish of Nelson, the works were formally inspected and opened on July 25th, when the scheme and its development were briefly explained by Mr. Raikes.

The total cost of the scheme is £16,356, which includes £14,366 for works and the remainder for land, easements and incidental expenses, but about half this expenditure is met by the £8,342 received under the conditions imposed by Parliament in the Act of 1912, which provides for sewering the Rhymney Valley, in which the rest of the Caerphilly district is situated.

The sewage disposal works consist of settling tanks and circular bacteria beds, similar to those which were constructed some years ago by the same engineers at Cefn Coed, near Merthyr Tydfil, and both schemes afford the means of very effectually preventing the pollution of the river, which previously occurred at these places.

The site of the disposal works is within the parish adjoining the Nant Mafon, about half a mile west of Nelson, which lies on the watershed between this and another small tributary of the River Taff, so the main outfall sewer had to be constructed in tunnel through the watershed to drain the north end of the village.

The construction of this tunnel involved very considerable difficulties, owing to the waterlogged character of the subsoil met with for a great part of its length, and the remainder was in very hard rock, which necessitated the use of compressed air drills and a considerable amount of blasting.

These difficulties were much less serious, however, than those involved by either of the alternative schemes previously proposed, which provided for disposal works within the borough of Merthyr, or irrigation on unsuitable land within the parish of Nelson, and the scheme adopted is undoubtedly the best.

The works were commenced in August, 1913, and about 100 men were employed in July, 1914; but this number was considerably reduced after the outbreak of war and during the winter months, although special lodging accommodation was provided by the erection of huts on the works.

A large proportion of the labour and material having been obtained locally, most of the money has been spent in the neighbourhood, and the total cost of the works is substantially less than most of the tenders received from other contractors, in spite of the war and other difficulties.

CAPACITY OF WORKS.

The new sewage disposal works are designed to provide for an ultimate population of 8,000, but as this is so much in excess of the present population, only six out of eight bacteria beds have been constructed at present, and these are sufficient to treat the sewage from 6,000 people, whereas the tanks, &c., are sufficient for 8,000. As there is no trade waste and the sewers only receive rainwater from the back roofs and paved yards, the sewage may be described as purely domestic, and the dry weather flow is estimated at 20 gallons per head per 24 hours. This represents 160,000 gallons per day, or, say, 260,000 tons per annum of foul sewage, which the works are designed to purify, together with the usual allowance for storm water before the effluent is discharged into a very small stream adjoining the main road.

The whole plant is so arranged that only one man is required to manage and control the entire process, which produces a bright and perfectly clean effluent, and the degree of purification is such as entirely to prevent the very serious pollution of the Nant Mafon which previously occurred. The site has the great advantage of affording ample fall for the process of purification to be carried out by gravitation, while the length and gradient of the main outfall sewer is such that the sewage reaches the works in a very short time after entering the sewers from the house drains. In order to provide a convenient means of access to the works a new bridge has been built over the Nant Mafon, with an entrance from the main road, and, although the land was inclined to slip before the works were constructed, this tendency has now been stopped by a thorough system of underdrainage to carry off the subsoil water with which the ground was previously saturated.

On reaching the works the sewage is discharged into a small detritus chamber, from which it passes over a gauging weir into the settling tanks. The latter are three in number, with a total capacity of 120,000 gallons, which is sufficient to treat sewage and storm-water up to a maximum rate equal to three times the estimated dry-weather flow of 20 gallons per head per day. When this rate is exceeded during wet weather, the excess passes by an overflow from the detritus chamber into the two storm-water tanks, which have a total capacity of 40,000 gallons, and the effluent from these tanks being comparatively dilute it is discharged direct into the stream.

ARRANGEMENT OF TANKS.

The general arrangement of the tanks is clearly shown on the accompanying plan, and they are all constructed on the same principle, each being provided with inlet and outlet weirs, which are specially designed to prevent the retention of any solid matter upon them and to ensure a uniform flow across the whole width of each tank. There are also scum boards to prevent the passage of floating matter over the outlet weirs, and the concrete floor falls towards the inlet end with a sludge channel down the centre.

For drawing off the supernatant water and sludge each tank is provided with a specially designed telescopic valve, which retains the sludge while the liquid above it is being decanted into one of the other tanks, and the sludge is then discharged by gravitation into the lagoons or drying-beds, which are also shown on the plan. While the sludge remains in these beds most of the liquid is evaporated, but some of it is collected by underdrains, which discharge on to a small irrigation area, which is reserved for its disposal so that when the sludge is sufficiently dry it can be carted out on to the neighbouring land as manure.

The effluent from the settling tanks is discharged on to the bacteria-beds by automatic syphons in the octagonal dosing chambers from which the outlets are connected with the automatic revolving distributors on each bed.

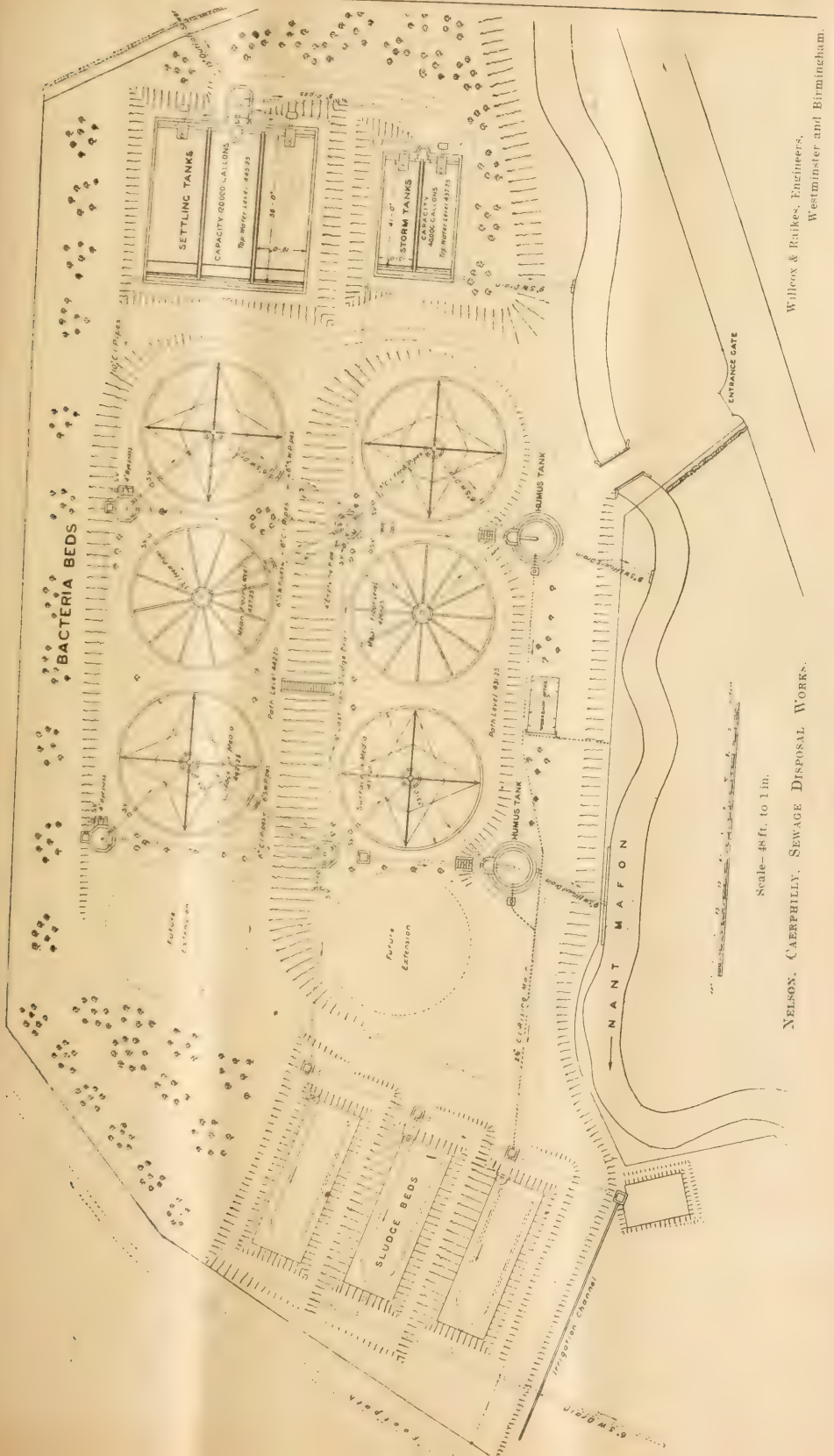
The distributors and dosing syphons are so arranged that the discharge is automatically suspended whenever the supply of tank effluent in the dosing chamber is insufficient to keep the distributors working at a rate which ensures perfectly uniform distribution over the whole surface of the bacteria beds in use. Each pair of syphons is also arranged to work alternately in order that each filter may receive a dose of sewage at intervals, which vary, according to the rates of flow from the tanks, and the discharge from each jet is very carefully adjusted, according to the area which it has to cover.

FILTERS.

The six filters are each 53 ft. in diameter, with an average depth of 5 ft., and, as they are constructed in two terraces of three each, the effluent from the high-level beds can be discharged on to the low-level beds for secondary treatment in dry weather, though this is in practice found to be unnecessary, the effluent from single filtration being quite satisfactory.

The filtering material with which the bacteria-beds are filled consists in hard, burnt furnace clinker, which was very carefully screened to remove dust and graded to the required size for each layer, which vary from 1½-in. gauge at the bottom to ½-in. gauge at the top.

Although the effluent from these bacteria-beds is very highly purified, it is still liable to contain a small quantity of suspended matter, which represents the inoffensive residue from the process of purification, and is very similar to garden soil or humus. In order to intercept this humus the filtered effluent is passed through two upward-flow circular tanks, which are specially designed for separating this very


SETTLING TANKS
CAPACITY 180000 GALLONS
STORM TANKS
CAPACITY 48000 GALLONS
BACTERIA BEDS
HUMUS TANK
HUMUS TANK
ENTRANCE GATE
NANT MAFON
SLUDGE BEDS
Future Extension
Irrigation Channel
Nelson. Caerphilly. Sewage Disposal Works.
Scale—48 ft. to 1 in.
Willcox & Raikes, Engineers,
Westminster and Birmingham.

light and finely-comminuted matter from the clean effluent which is finally discharged into the stream. Each of these humus tanks is 16 ft. deep and 13 ft. in diameter, with the inlet pipe near the bottom, and the effluent is drawn off over white glazed weirs round the top, so that the liquid passes very slowly upwards while the solid matter settles to the bottom. With this arrangement the solids are separated by the natural coagulation of fine particles, and a hand pump is provided by which the deposit can be discharged on to the sludge beds when necessary without emptying the tanks.

The entire scheme has been carried out by Mr. H. E. Buckley, contractor, Bradford, under the immediate supervision of the resident engineer, Mr. W. I. Williams, and the engineers, Messrs. Willcox & Raikes, of Birmingham, have received many congratulations on its success. The Caerphilly Urban District Council may also be congratulated on the completion of the scheme at a cost which only represents about £1 per head for the population provided for in the sewers and sewage disposal works respectively, in spite of the increased prices since the outbreak of war, when a considerable part of the work was still uncompleted.

ROAD MAINTENANCE IN WARWICKSHIRE.

COUNTY SURVEYOR AND WAR-TIME DIFFICULTIES.

The nett cost of ordinary road maintenance in Warwickshire during the year 1915-16 was £41,721. This, Mr. John Willmot, the county surveyor, mentions in his annual report, is equal to a rate of £90·9 per mile, £21·4 less than last year, and £32·6 less than in 1913. Mr. Willmot says, however, that it must not be assumed that the needs of the roads are decreasing, for they were never subject to such heavy traffic as they are now. The reduction in the cost is entirely accounted for by the abnormal conditions which have prevailed during the past two years.

Figures given in the report show that a gradual increase in the motor receipts, which has taken place each year since the Locomotives Act, 1898, and the Motor Car Act, 1903, came into force, has for the present stopped, and last year's total receipts show a slight decrease on the previous year's figures, though the receipts under the head of locomotives have slightly increased. The total amount received, £2,053, represents a rate of £4 10s. per mile, on the total mileage of the roads directly maintained by the council, and would provide for the maintenance at the present rate per mile of about 22 miles of road for a year, or would cover the cost of surface tarring about 35 miles of roads of an average width.

PRICES OF MATERIALS.

The average prices per ton paid for the various kinds of road material purchased during the year were as follow: Granite and basalt, 8s. 4d; Warwickshire stone, 8s. 3d.; tarred material, 12s. 9d.; slag, 5s. 6d.

TARRING WORK.

The bulk of the surface tarring was done by the council's own men. The area dealt with was 909,600 sq. yds., and the cost £4,928, the cost per square yard being 1·30d.

The area tarred extends over a length of about 113 miles of road—about one-fourth of the total mileage maintained by the council. About 138,300 gallons of tar were used, and the area covered per gallon was 6·6 sq. yds., as compared with 6·7 sq. yds. in the previous year. The cost per square yard was rather less than in that year, as the tar was bought at a cheaper rate.

In addition to the above 144,000 sq. yds., representing a length of about 12 miles, chiefly on roads included in the Road Board scheme, were tarred by Tarmac, Limited, at a cost of £900, or 1½d. per square yard.

Apart from the Road Board lengths, no portion of the main roads were coated with tarred material, but upwards of 900 tons of Tarmac were used in patching and filling up potholes—for which, Mr. Willmot observes, this material is admirably suited.

MAINTENANCE PROBLEMS.

"I need hardly say," remarks Mr. Willmot, "that the year just closed has been a very exceptional one. The facts and figures given in the report will show this. The difficulty has been that while many of the more important roads have been subjected to military traffic, which is heavier than the ordinary traffic of the district, the means for carrying out repairs have been far less than usual. The policy of maintaining to a proper standard the roads subject to the heaviest traffic has been adopted, with the result that roads on which the traffic is not so heavy have had to suffer, and are now in need of considerable repair. I have endeavoured, as far as possible, to keep these roads going by filling up the potholes and metalling the worst places, which will, I hope, prevent them getting into a worse condition. There does not at present seem any probability that full supplies of material will be obtained, and with depleted staffs both on the roads and at the quarries, it is evident that the necessary work will have to be carried out under even greater difficulties during the present financial year."

ECONOMY OF TARRED MATERIAL.

With the exception of a few short lengths, the work on which has been postponed at the request of the Road Board until after the war, the whole of the work under the Road Board scheme has been completed. The roads that have been improved are standing up well to the special traffic they now have to carry, and the county surveyor regards it as very fortunate that the work was finished before the increase in the traffic occurred. He trusts it may be possible in the near future, and under happier conditions, to arrange for a somewhat similar scheme on even a larger scale, as he is satisfied that water-bound roads will not stand up to the present traffic, and that it will be true economy to use tarred material in the future.

Mr. Willmot mentions that the urban authorities have experienced the same difficulties in maintaining their roads as the council have had with those under direct control, and from the same causes—viz., shortage of men and materials—but under the circumstances, the roads, although in some cases not kept up to quite the usual standard, have, on the whole, been fairly maintained.

MOTOR 'BUSES AND THE HIGHWAYS.

GRANTHAM'S SCALE OF CHARGES.

Grantham Town Council have adopted a proposal of the Watch Committee consenting to motor omnibuses plying for hire on the highways on routes beyond those used on or before March 1, 1914, on payment of the following annual fees; Under a ton weight, £5; over a ton and under 2 tons, £7; over 2 and under 2½ tons, £10; over 2½ and under 3 tons, £15; over 3 and under 4 tons, £20; over 4 tons, £25; the payments to be made in advance by two equal half-yearly instalments in May and November. Consent will not be granted unless omnibuses are submitted for inspection in May and November, and certified as sound and in good running order.

Aldershot Camp Sewage Farm.—At the last meeting of the Thames Conservancy, the River Purification Committee reported that as the result of letters to the War Office respecting the inadequacy of the North Camp sewage farm, Aldershot, and the consequent serious pollution of the river Blackwater, the military authorities had now accepted a tender for the execution of the scheme proposed.

Main Road Control in Herefordshire.—Ross Rural District Council discussed recently the scheme of the county surveyor, Mr. G. H. Jack, for taking over the sole control of the main roads in Herefordshire. The chairman (Alderman T. Preece) said this was the most important matter that had been before the council for years, and his opinion was that if the rural councils of Herefordshire allowed the county council to take the sole control of these roads that policy would entirely kill local interest and vastly increase public expenditure. The farmers and agriculturists found 70 per cent of the county rates, and they were the people who should have a voice in the control of the roads. After discussion the council unanimously decided to send a report to the county council to the effect that the Ross Council is unanimously of opinion that in the best interests of the ratepayers of the county, the county council should be requested to continue the present system of management of the main roads.

REVENUE FROM REFUSE.

DE-TINNING COMPANY'S SCHEME AND INVITATION TO LOCAL AUTHORITIES.

Not the least profitable among the numerous side-lines of German trade in pre-war days was the treatment and re-use of the old tins which form so large a proportion of domestic and other refuse. Pressed into bales of convenient size, hundreds of thousands of tons of this discarded material found its way across the North Sea to our Teutonic neighbours, who, after extracting from the tins the valuable by-products in the shape of tin, spelter and so forth, returned them to us in the form of toys, brush and mirror backs, purses and trays—to mention but a few articles. With the suspension of traffic between the two countries vast stores of old tins have accumulated here, and engineers to public bodies, engineering firms and military camp authorities are faced with an unexpected problem. For the profitable utilisation of such refuse machinery of a special character is needed, and it is with the object of meeting this demand, and, incidentally, of ensuring that, when peace comes the trade in these old tins does not return to Germany, that the British De-Tinning Company, 75, New-street, Birmingham, are launching the project to which reference was made in a recent issue of this journal. At a meeting of representatives of local authorities which is to be held in London next month, the company will explain their scheme by which those bodies, working on co-operative lines, can dispose of their stores of waste metals with more advantage to themselves than has hitherto been possible. Among the several authorities who have already made a working agreement with the company is the Southwark Borough Council, whose enterprise in the past in the matter of the disposal of refuse is well-known. Mr. Arthur Harrison, the borough engineer, has taken up the De-Tinning Company's process with enthusiasm, and before long Southwark will be in possession of a building and plant, which the firm will erect at a cost of £3,000. When finished this will be handed over in working order to the council, who in consideration are to pay the company 50 per cent of the additional profits accruing from its use.

Next month's meeting promises to be very largely attended, and evidence of the keen interest which is being displayed in the company's scheme—particularly by municipal engineers—is supplied by the list of acceptances which have already been received, and from which we may quote the following names: Messrs. E. E. Finch, city engineer, London; W. Grieg, Glasgow; H. E. Stilgoe, city engineer, Birmingham; F. J. Rushbrooke, borough surveyor, High Wycombe; T. Reader Smith, borough surveyor, Kettering; J. Bird, borough engineer, East Ham; S. Maylaw, engineer and surveyor, Basford; Henry J. Kilford, borough engineer, Ilkeston; F. T. Clayton, borough engineer, Reigate; J. Sutcliffe, borough engineer, Woolwich; W. H. Taylor, engineer and surveyor, Aylesbury; W. H. Grieves, surveyor, Sutton, Surrey; C. R. W. Chapman, surveyor, Wembley; Percy Bennett, engineer and surveyor, Harrow-on-the-Hill; W. W. Cooper, engineer, Slough; D. Roberts, borough surveyor, Lewes; R. H. Jeffes, engineer and surveyor, New Malden; H. Mason, surveyor, Swadlincote; J. C. Radford, Wandsworth; J. E. Hargreaves, engineer and surveyor, Farnborough; Frank Marshall, borough surveyor, Morecambe; W. H. Hambleton, Salford; Horace White, surveyor, Loughton; W. Jones, engineer and surveyor, Colwyn; H. C. Sugden, health superintendent, Colne; A. J. Munro, sanitary inspector, Enfield; H. Gilbert Whyatt, borough engineer, Grimsby; P. A. Benn, city surveyor, Lichfield; E. R. Capon, surveyor, Epsom Urban; Samuel Hutton, engineer and surveyor, Exmouth; J. H. Brierley, borough surveyor, Richmond, Surrey; T. W. A. Hayward, borough surveyor, Battersea; S. H. Chambers, engineer and surveyor, Hampton; P. Dodd, borough engineer, Wandsworth; W. H. Maxwell, borough engineer, Tunbridge Wells; A. C. James, surveyor, Grays; T. B. Crookes, cleansing superintendent, Finsbury; Edward Willis, surveyor, Chiswick; F. Hall Smith, surveyor, Sheringham; Walter R. Locke, engineer, Hemel Hempstead; M. W. Jameson, borough engineer, Stepney; R. Hampton Clucas, borough surveyor, Kingston-on-Thames; William Banks, city surveyor, Rochester; C. Brown, surveyor, Edmonton; William F. Loveday, borough surveyor, Stoke Newington; F. Wood, borough surveyor, Fulham; C. W. Marks, borough surveyor, Wokingham; F. Wilkinson, borough surveyor, Deptford; T. W. Taylor, borough engineer, Ramsgate; H. W. Tomlinson, borough surveyor, Luton; J. Taylor, borough surveyor, Walsall; J. B. Williams, borough surveyor, Daventry; E. Morley, borough surveyor, Walthamstow; J. E. Hattersley, borough surveyor, Buckingham; W. N. Blair, borough engineer, St. Pancras; F. Ayton, Ipswich; I. I. Peacocke, city surveyor, Limerick; E. J. Heward, borough surveyor, Greenwich; E. J. Elford, borough engineer, Southend-on-Sea; F. White, chairman, cleansing sub-committee, Scarborough; Thomas Moulding, city engineer, Exeter; F. H. French, borough surveyor, Harwich; A. E. Nichols, borough engineer, Folkestone; E. A. Borg, borough engineer, Margate; William Banks, city surveyor, Rochester; F. Sadler, surveyor, Acton; E. Morley, surveyor, Walthamstow; D. Waterhouse, engineer and surveyor, Watford; J. D. Kennedy, borough surveyor, Retford; J. E. Carey, engineer and surveyor, Heston and Isleworth; J. A. Crowther, borough engineer, Southampton; W. T. Patrick, Guildford; S. Milnes, Stroud; and W. R. Hicks, borough engineer, Ealing. Other authorities to be represented at the meeting include: City of Westminster, Torquay, Newport, South Shields, Leicester and Swansea.

We are asked to say that surveyors who desire to attend and have not received an invitation to the meeting should communicate at once with the company.

STEAM TRACTORS FOR REFUSE COLLECTION.

A COMPARISON WITH HORSE HAULAGE.

Mr. H. Hopkinson, cleansing superintendent to the Portsmouth Corporation, has submitted the following in connection with the discussion on steam tractors which took place at the recent conference of the Institute of Cleansing Superintendents at Cardiff:—

Cost of Collection of House and Barrack Refuse by Steam Motor ("Foden") Wagon and Trailer.

Carrying capacity of Wagon attached to motor	...	11½ cub. yds.
" " " Trailer " " "	...	11 " "
		22½
Weight per load of Wagon ... ... 3 cub. yds. per ton ...		3 tons 13 cwt. 1 qr.
Trailer ... ... 3 " " " ...	...	3 " 13 " 1 "
		7 " 6 " 2 "
2 loads per day of both wagon and trailer ...	...	14 tons 14 cwt.
Cost " " " " " ...	...	Fuel, &c., 4s. 7½d.
		Wages ... 8s. 4d.
		Total... 12s. 11½d.
14 tons 13 cwt., or 44 cub. yds., cost	... ...	12s. 11½d.
1 ton, " 3 " " "	... ...	10½d.
6 cwt. 2 qr., " 1 " " "	... ...	3½d.

Cost of House and Barrack Refuse Collection by Corporation Horse and Cart.

Carrying capacity of ash cart	4 cub. yds.
Weight per load of ash cart (average)	1 ton, 6 cwt.
Average No. of loads per horse—2½ per day = 3 tons, 5 cwt.	
Cost per day for 1 day's work	10s. 4d.
Therefore:—	
45 horses collect 112½ loads, or 450 cub. yds., average weight, 146 tons, 5 cwt., costing	£23 5s. 0d
1 horse will collect 2½ loads, or 10 cub. yds., average weight, 3 tons, 5 cwt., costing	10s. 4d.
1 horse will collect 1 load, or 4 cub. yds., average weight, 1 ton, 6 cwt., costing	4s. 1d.
1 horse will collect ¼ load, or 1 cub. yd., average weight, 6 cwt., 2 qr., costing...	1s. 0½d.
3 cub. yds., average weight, 1 ton, costing	3s. 0½d.

So it will be seen by the above that the cost of haulage by motor is 2s. 2½d. less per ton (3 cub. yds.), or 9½d. less per cub yd. (6 cwt. 2 qr.).

Horse.

	Loads		Cub. yds.	Weighing Tons	cwt.	Costing £	s.	d.
In 1 day 1 horse collects	2½	or	10	3	5	0	10	4
In 1 week 1 " "	15	or	60	19	10	3	2	0
In 1 year 1 " "	780	or	3,120	1,014	0	161	4	0

Motor and Trailer.

	Loads		Cub. yds.	Weighing Tons	cwt.	Costing £	s.	d.
In 1 day 1 motor and trailer collects	2	or	14	14	13	0	12	11½
In 1 week 1 motor and trailer collects	12	or	264	87	18	3	17	9
In 1 year 1 motor and trailer collects	624	or	13,728	4,570	16	202	3	0

Surveyors' Petrol Allowances.—At the last meeting of East Preston (Sussex) Rural District Council, the surveyor, Mr. C. W. Leney, stated that the Petrol Control Committee had allowed him only six gallons of petrol for thirteen weeks for his motor cycle. If he was properly to supervise his men and work he required at least 18 gallons, and he asked the council to support his application for a larger supply than that allowed. This the council decided to do.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bridport T.C.—The borough surveyor, Mr. F. Cooper, has prepared a report on a scheme of proposed repairs and alterations to the town hall.

Cumberland C.C.—It was reported that the final cost of the new bridge over the Esk was £16,261, or £1,024 less than the original contract, £17,266. The council agreed, on account of the unforeseen cost incurred by the contractors in order to complete the work without delay, to make a grant of £500 extra towards this expenditure. It was also resolved that, as the difficulty in obtaining labour arose on account of the high wages paid at Gretna, and that as the work at Gretna made it important that the bridge should be finished without delay, the Munitions Department be approached with a request for a grant towards the extra cost. In conclusion, the thanks of the council were given to the county surveyor, Mr. W. Finch, and his staff, for the excellent manner in which they had carried out the work, an honorarium of 100 guineas being voted to them for the extra services which they had been required to render.

Exeter T.C.—The borough surveyor, Mr. T. Moulding, submitted to the Sanitary Committee tenders for the erection of a four-bed smallpox pavilion, with nurses' room and out-offices, together with the necessary roadmaking and draining, and the committee recommend that the tender of Mr. E. C. Lea, at £1,215, be accepted.

Halifax T.C.—The borough engineer, Mr. J. Lord, has been authorised to obtain tenders for the construction of a concrete bridge at Clark Bridge.

Stockport T.C.—The Electricity Committee recommend the purchase of property in Millgate, at a cost of £2,700, for the erection of a generating station.

Stockton T.C.—The deputy borough engineer reports that the estimated cost of repairs to Yarm-road and Hartburn railway bridges will be £1,089.

Thurlstone (Yorks) U.D.C.—The need for a mortuary was discussed recently, a medical member stating that it was a horrible thing to hold a post-mortem in a cottage. It was decided to defer the matter until after the war.

West Sussex C.C.—"Wren House," Chichester, designed by Sir Christopher Wren, dated 1696, and the residence of the late Sir Arthur Fairbairn, has been bought for £5,500 by the West Sussex County Council for offices.

HOUSING AND TOWN PLANNING.

Burry Port U.D.C.—Representations are being made with a view to obtaining a Government grant towards the cost of building 200 houses for a permanent departmental staff and workmen.

Chesterfield T.C.—A sub-committee has been asked to report upon the desirability of a local housing scheme.

Coalville U.D.C.—The surveyor, Mr. L. L. Baldwin, has been asked to report upon a proposal to build houses at Whitwick.

Felling U.D.C.—A committee has been appointed to consider the question of a town planning scheme.

Shrewsbury T.C.—The town council have authorised the Improvement Committee to take the necessary steps for promoting a town planning scheme.

MOTOR TRANSPORT.

Barrow T.C.—It is proposed to purchase an electric battery vehicle.

Bradford T.C.—The city council are asking permission to borrow £3,700 for the provision of three battery tip-wagons.

Chester-le-Street R.D.C.—It is proposed to purchase two Foden 3-ton end-tipping wagons, at £660 each.

Ilford U.D.C.—The surveyor, Mr. H. Shaw, has been asked to prepare a report on motor lorries and motor street-watering vehicles.

Newcastle-on-Tyne T.C.—The city council have confirmed the proposal of the Watch Committee to purchase, for £1,271, an additional motor fire engine, a duplicate of that bought for £1,296 at the beginning of the year, the difference in the price being due to the fact that some spare parts and minor accessories would not require to be duplicated.

REFUSE COLLECTION AND DISPOSAL.

Richmond (Surrey) T.C.—At the last meeting, the Surveyor's Committee presented a report on the proposal to burn the Richmond refuse in a dust destructor to be erected on the works of the main sewerage board at Mortlake. The report stated that the engineer to the board, Mr. W. Fairley, estimated the total capital expenditure to be provided by the corporation for buildings, machinery and plant at £12,500, and the total estimated annual cost to the corporation at £1,412. The corporation now paid to the contractors, for removal by rail, 7,600 tons at 4s. 6d. per ton, £1,710, and on present war conditions the scheme showed an estimated saving to the corporation of £298 a year, and on pre-war conditions an increased cost of £177 a year. A member strongly denounced the agreement on the ground that under it Richmond would have to pay £12,500 for a dust destructor which would not be their property. At the end of the period for which the money was borrowed the Sewerage Board could do what they liked. Finally the question was referred to the Surveyor's Committee with instructions to obtain further information, and to prepare an alternative scheme.

ROADS AND MATERIALS.

Accrington T.C.—By the offer of a piece of land in Hyndburn-road, the town council will be enabled to carry out a widening scheme at an estimated cost of £50.

Berks C.C.—An estimate of the damage caused by military traffic on the main road from Reading through Shinfield and Aborfield is being prepared with a view to a claim being made on the War Department.—The Road Board have made a grant of £1,505 for surface tarring.

Blackpool T.C.—The town council have referred to a sub-committee a proposal for the extension of the promenade southwards, and the development of the South Shore.

Burgess Hill U.D.C.—The council have accepted the tender of Messrs. Chittenden & Simmons for the hire of a steam roller with scarifier, at 30s. per day.

Cheshire C.C.—In the course of the last meeting, the chairman, Colonel Dixon, alluded to the question of the employment of German prisoners of war from Handforth Camp in repairing certain Cheshire main roads. A letter had, he stated, been received from the commandant of the prisoners' camp and the general officer commanding, intimating that it would not be advisable to employ them. Also there would be difficulty in transporting the men to work in different parts of the county, owing to the petrol restrictions.

Croydon T.C.—The council agreed to the recommendation of the Roads Committee for the acceptance of the following tenders for horse hire, for the six months commencing October 1st next: Croydon district, Mr. A. Bullock: Norwood district, Mr. Jason Ive. The price for the Croydon district is increased by 6d. per man and 3d. per horse per day, representing an increased cost to the department for the six months of £150. The price for the Norwood district is the same as at present paid.

East Grinstead R.D.C.—The surveyor, Mr. C. Turton, has been authorised to obtain for experimental purposes one truck of "Bituspray," and the necessary covering material to treat a portion of the district road, at a cost of about £30.

Exeter T.C.—The city surveyor, Mr. T. Moulding, has been requested by the Streets Committee to report generally on the method of construction of roads within the municipal boundary. The city surveyor reported that in the past difficulties had arisen in connection with the reinstatement of openings in roads and footpaths. He had interviewed the secre-

tary of the Exeter Gas Company, and it was agreed that the most satisfactory way of overcoming the difficulty would be for the city council to make good excavations at the cost of the persons making such openings. The Streets Committee resolved that the city surveyor be authorised to make arrangements with the gas company for the reinstatement by the council at the company's expense of all roads and footpaths opened up by the company, and subject to the latter indemnifying the council against all actions and claims by third parties arising from or in consequence of such work.

Halifax T.C.—The borough engineer, Mr. J. Lord, has been instructed to carry out the street widening at Barum Top and in King's Cross-lane, near the junction of Bull Green and Barum Top, at an estimated cost of £500.

Lanarkshire C.C.—It was stated at a meeting recently of the Middle Ward Committee that in connection with the upkeep of the roads it would be necessary to do a good deal of tar-macadam work, and that a grant towards the expenditure had been obtained from the Road Board.

Oulton Broad U.D.C.—The council have accepted the offer of the Great Yarmouth Gas Company for the supply of tar at 12s. 6d. per cask.

Reading T.C.—An estimate of £1,575 has been approved for permanent way renewals.

Richmond (Yorks) R.D.C.—The council on Saturday rescinded a former resolution which they passed to support the making of a new road from Richmond. The chairman (Mr. G. T. Gilpin-Brown) said the county council had declined to take the road over as a main road, as was suggested by the Road Board. The council had ascertained that the cost of maintaining it would be about £2,000 per annum, and they were not willing to incur such a liability, seeing that the road would only serve the services of the camp.

Scarborough R.D.C.—The surveyor, Mr. J. A. Iveson, reported that the county council had made a special grant of £300 for tar-spraying the main roads.

SEWERAGE AND SEWAGE DISPOSAL.

Bournemouth T.C.—The borough surveyor, Mr. F. P. Dolamore, has been authorised to proceed with the drainage of the cliffs in the vicinity of the Toft Steps.

Chester-le-Street R.D.C.—It was stated that so many officers had been allowed to join the forces it was impossible to carry on the sanitary work of the district, and the council referred the matter to the Staff Organisation Committee.

Fifeshire C.C.—In order to cope with the periodical flooding at Inverleven the Kirkcaldy District Committee have agreed to contribute two-thirds of the cost, estimated at £100, of laying an additional 12-in. pipe.

WATER, GAS, AND ELECTRICITY.

Bradford T.C.—The Local Government Board have vetoed a proposed loan for the extension of the electrical plant. They have, however, sanctioned proposals for the extension of mains without reference to the department.

Derby T.C.—Water main, electricity, and sewer extensions are to be carried out at an estimated cost of £6,650.

Halifax T.C.—A sub-committee has been authorised to consider the question of installing plant for the supply of benzol and toluol.

Hammersmith B.C.—Further negotiations with the Treasury and the Board of Trade are proceeding with reference to the scheme for linking up the electricity undertaking with those of Fulham and Battersea. The communication link between Fulham and Battersea has already been established.

Salford T.C.—The Gas Committee recommend that application be made to the Local Government Board for a further sanction to borrow £10,000 to cover capital expenditure in connection with the gas undertaking in respect of loans sanctioned last year.

Waterford T.C.—The City of Waterford Gas Company proposed to increase the price of gas supplied to the corporation by 50 per cent, and to reserve the right to substitute flat flame burners, consuming not less than 4 cub. ft. per hour, in the event of their not being able to obtain a sufficient supply of mantles. The town council have passed a resolution objecting to any increase of price beyond 25 per cent, and claiming the power to reduce the number of lamps if this was considered desirable.

MISCELLANEOUS.

East Grinstead U.D.C.—The surveyor, Mr. C. Turton, has been authorised to purchase six dozen scavenging brooms at 35s. per dozen.

Hartlepool T.C.—The town council have referred the provision of a sand screen at Throston to the Improvement and Property Committee.

Okehampton R.D.C.—The surveyors (Mr. S. Hooper and Mr. G. Smale), who are acting as sanitary inspectors in the absence on military service of Mr. Hugh Ward, the sanitary inspector, having been requested by the council to suggest a sum as remuneration for their services during the past year, asked that they should be given an honorarium of £10 each. The sum was considered reasonable, and payment was ordered.

FOR OTHER ADVERTISEMENTS
See End of Paper.

URBAN DISTRICT COUNCIL OF BEESTON (NOTTS).
SURVEYOR AND INSPECTOR OF NUISANCES.

The above Council invites applications for the post of Surveyor and Inspector of Nuisances. The person appointed must devote whole time to the service of the Council, reside in the district, be competent to prepare plans, specifications, estimates, &c., have a thorough knowledge of construction and maintenance of roads. Applications should be made in own handwriting, stating age, experience, qualifications, &c., accompanied by copies of not more than three recent testimonials. Envelopes to be sealed and endorsed "Surveyor and Inspector," addressed to me, the undersigned, not later than September 1st. Salary £225 per annum (Surveyor £105, Inspector £120). The appointment as Inspector will be subject to the approval of the Local Government Board and to the regulations made by them.

Canvassing the Members will disqualify.

(By order of the Council)

W. H. REDGATE,
Clerk.

Bentinck Buildings,
Wheeler Gate, Nottingham.
August 10, 1916. (3,068)

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Assistant in County Surveyor's Office. Must have good knowledge of modern road and bridge construction, be an active motor cyclist, and ineligible for the Army. Apply, giving age, full particulars of experience, salary required, &c., to

GORDON R. FOLLAND,
Acting County Surveyor.

13 Chamberlain-street,
Wells, Somerset. (3,066)

BOROUGH OF HEMEL HEMPSTED.
SURVEYOR'S ASSISTANT.

Applications are invited from men ineligible for military service during the absence of one serving with the Colours. Salary £80 to £100, according to experience.

Forms of application may be obtained from the undersigned, to whom they should be returned not later than August 26th.

W. R. LOCKE,
Borough Surveyor.

Town Hall,
Hemel Hempsted.
August 9, 1916. (3,069)

MENSTON PARISH COUNCIL.

Tenders are invited for 12 Street Lamp Standards which have been taken up owing to alteration in lighting. Tenders must reach me not later than Tuesday, the 5th September, 1916.

PHIL. S. WADE,
Clerk.

Union Offices,
Otley. (3,067)

WANTED—THE SURVEYOR, January 20, 1899, and February 23 and March 2, 1900. Offers to the Publisher, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

PERSONAL.

Mr. W. T. Hatch, engineer in chief to the Metropolitan Asylums Board, has resigned.

Mr. J. R. Denbow, highway surveyor to the Kingsbridge Rural District Council, has received an increase of salary.

Mr. Percy Morris, town planning assistant to the Doncaster Rural District Council, has been appointed surveyor to the Leigh Rural District Council.

Mr. J. Bintley, county surveyor of Westmorland, has been injured and severely shaken in a driving accident, the horse having taken fright at a train.

Mr. I. F. Wardle, surveyor to the Bolsover Urban District Council, was married recently to Miss Ruth Twigge, third daughter of Mr. and Mrs. T. G. Twigge, of Steeple Grange.

Lieutenant Walter J. Houghton, Assoc.M.Inst.C.E., M.R.S.I., a member of the city engineering staff of Cape Town, is serving with the British forces in German East Africa.

Mr. Singleton Goodwin, M.Inst.C.E., county surveyor of Kerry, has received a vote of sympathy from the county council upon the death of his only son, Lieutenant Goodwin, at the front.

Mr. S. L. Christie, burgh surveyor of Montrose, has been granted conditional exemption from military service. In addition to his own duties he is acting on behalf of the burgh surveyor of Arbroath, who is with the colours.

Mr. S. Mitchell, surveyor to the East Kerrier Rural District Council has resigned, having received an appointment under the Norfolk County Council. He told the rural council that his salary was insufficient to meet his liabilities.

Mr. Edward Wembridge Ingamells, the district surveyor at Southbourne, has been appointed deputy borough engineer of Bournemouth at a salary of £325, and Mr. Harold Robert Homewood, of the borough engineer's department, has been appointed to take Mr. Ingamells' position at Southbourne, at a salary of £175.

Mr. H. C. Cordon, surveyor to the Aylesbury Rural District Council, has received permission from the council to accept a "small honorarium" from the Road Board for assistance given in the construction of certain camp roads. The chairman, Mr. J. W. Grist, expressed gratification that Mr. Cordon's work had been appreciated by the Road Board.

Mr. W. S. T. Haseldine, assistant surveyor, has been appointed surveyor to the Wath-on-Dearne Urban District Council, in succession to Mr. J. H. Drew, who has been appointed borough surveyor and waterworks engineer at Grantham. Mr. Haseldine has been loaned to the Road Board, who are willing to release him when required. The salary is £160 per annum.

Mr. W. J. Steele, city engineer of Newcastle-on-Tyne, read a paper, entitled "The King's Highway," recently, before the members of the Newcastle Rotary Club. In the course of his remarks he said there was no doubt that when all traffic was mechanically driven, one of the difficulties of road construction and maintenance would be removed, but generally the cost would be very much higher, as many roads would have to be entirely reconstructed, and others strengthened to carry traffic which would be very much heavier than at present. The annual cost of maintaining, cleansing, watering and lighting the highways of Newcastle was equivalent to an average of £340 per mile, 6s. 4d. per head of the population, and 1s. per £ of the assessable value.

Mr. F. Reginald Phipps, borough surveyor and waterworks engineer of Basingstoke, whose valuable paper on Diesel engines, read at the recent annual meeting of the Institution of Municipal and County Engineers, is reproduced on another page of this issue, was articled to the borough surveyor of Tewkesbury, from 1903-7, afterwards becoming engineering assistant to the city engineer of Worcester, and being engaged in the carrying out of various large undertakings, including waterworks extension, a sewerage scheme with ejectors, storm overflow provision, street improvements, and the construction of a river embankment. In 1903 he was appointed borough surveyor and waterworks engineer at Basingstoke, where numerous important works carried out under him have included a new water supply scheme, sewerage and sub-drainage (reducing the amount of sewage pumped by one-half), the provision of a refuse destructor (utilising steam for pumping sewage), an open-air swimming bath, a new cemetery with chapel, lodge, &c., and a new fire station. In 1914 he completed an electric lighting scheme for the town, at a cost of £14,000, the motive power being Diesel engines, which, as stated

Mr. F. Reginald Phipps,
Borough Surveyor and Waterworks Engineer, Basingstoke.

forms the subject of the paper read at Blackpool. Mr. Phipps is an associate member of the Institution of Civil Engineers, a fellow of the Surveyors' Institution, a member of the Institution of Municipal and County Engineers, and qualified by examination as a member of the Royal Sanitary Institute.

KILLED IN ACTION.

Lieut. I. L. Peacocke, of the Royal Engineers (Ulster Division), formerly surveyor and water engineer of Newtownards, has been killed in action.

Private Alexander Brown, burgh surveyor and engineer of Wishaw, has fallen in the fighting line. He was 28, and joined the Cameronians eight months ago. His battalion was engaged in consolidating ground gained in a wood when he was struck by the fragment of a shell.

Second-Lieutenant G. R. B. Mazengarb, of the 1st East Surrey Regiment, a nephew of Mr. H. W. Longdin, surveyor to the Penge Urban District Council, and articled to him, was, we regret to state, killed in action on July 29th. Mr. Mazengarb was the only son of Mr. and Mrs. G. A. Mazengarb. He was educated at the Coopers' Company School, where he was captain of the school, and won the school championship at sports. After matriculating at the London University, he was articled to Mr. Longdin, and was enrolled as student of the Surveyors' Institution and the Institution of Municipal and County Engineers. He joined the Inns of Court O.T.C. in December, 1914, and received his commission in March, 1915, being gazetted to the 3rd East Surrey Regiment. He was attached to the 1st Battalion in August, 1915, and was serving with it when killed. His Colonel writes: "He was one of the finest characters I have ever met; his utter unselfishness and devotion to duty was most marked. I mourn not only the loss of a very gallant officer, but also one who had become to us all a very dear comrade." Deceased was only twenty years of age, and was a fine all-round athlete.

DARTMOUTH AND MOTOR TRACTION.

BOROUGH SURVEYOR'S INQUIRY.

Mr. F. J. Voisey, borough surveyor of Dartmouth, writes: "The Dartmouth Town Council contemplate substituting motor for horse traction in removing the town refuse. Would any of your readers who have adopted this means of locomotion, or makers of suitable vehicles, communicate with me? Ours is a small town of 7,000 inhabitants, and a hilly district."

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.

The first distribution of certificates in the new premises to which the school has been removed was held on 18 August, and the building, being situated approximately midway between the two Crystal Palace stations, and close to the South Tower, it did not come. The president of the Institution of Civil Engineers who let his audience into the secret that in his younger days he had become Colonel Ross), after describing the practical character of the work of the school, and the excellence of the exhibits in the classrooms that day, alluded to the Institution of Civil Engineers' requirements for membership and to the advantages offered in the Crystal Palace School to those desiring the office or profession of a civil engineer.

After a vote of thanks to the examiners, Messrs. H. C. H. Shenton, F.S.E., and Gordon W. Harris, M.I.MECH.E., the principal addressed the meeting.

Mr. A. T. Walmisley, M.INST.C.E., engineer to the Dover Harbour Board in proposing a vote of thanks to the chairman, said it was appropriate that Mr. Ross should preside at this first distribution of certificates in the new premises of the school in view of the very great interest which he was known to take in the welfare of the young engineer. Mr. Walmisley, turning to the students, then said that at the conclusion of the course of training in this school it was not expected that students could settle questions requiring skilled practice. The ability to deal with such matters efficiently could only be acquired by definite experience. But, he added, "you are expected intelligently to comprehend fundamental principles, so as to be able to appreciate their application in any work committed to your care." He did not think it possible to make excellence in a design without the aid of a drawing, and for that reason he was pleased to see so many good drawings exhibited that day. The school always turned out good draughtsmen. He had in the past had occasion in his office, but as regards the graphic diagrams, which, so far as seen in the classroom, were excellent, he might add a word of caution for future work, and that was, in dealing with graphic methods, never to draw a line or a curve for which one was unable to give mathematical proof, as nothing upset a design so fatally as a line wrongly drawn on a graphic diagram. To secure accuracy, repetition must never exclude thought. Difficulties were our daily experience, but must not discourage us. Like the weights on old-fashioned clocks, difficulties were not made to stop us, but to keep us going. The history of all success was the history of difficulty overcome.

Mr. Ross expressed his appreciation of the reception given to him.

MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL MEETING PROGRAMME.

The annual meeting of the Municipal Tramways Association will be held at the Surveyors' Institution, Westminster, on Thursday and Friday, September 21st and 22nd.

The proceedings will open at 11 o'clock on the Thursday, when Mr. Peter Fisher, general manager of the Dundee Corporation Tramways, will deliver his presidential address.

The following papers will be submitted for discussion:

"Some Notes on Passenger Transportation in Large Cities," by Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways.

"Utilisation of Tramways for Goods Traffic," by Messrs. G. W. Holford, general manager of the Salford Corporation Tramways, and W. Clough, general manager of the Bury Corporation Tramways.

Exmouth Marine Parade.—In connection with this work, an account of which appeared in our issue of last week, we are informed that Messrs. Tom Wilkinson & Co., the Bridge Wharf, Poole, Dorset, are the contractors for the reinforced-concrete roadway to which reference was made, as well as for the half mile of reinforced concrete and masonry sea defence work carried out by the district council (Mr. Samuel Hutton, engineer). Messrs. P. Wilson & Co. are the contractors for Lord Clifden's wall (Messrs. Douglass, Lewis & Douglass, engineers).

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

DISTRICT SURVEYOR.—August 14th. Alresford Rural District Council. £150.—Mr. J. Ridley Shield, clerk, East-street, Alresford, Hants.

TEMPORARY MAIN ROAD SURVEYOR.—August 19th.—Cornwall County Council. £150 per annum.—Mr. L. D. Thompson, county surveyor, County Hall, Truro.

HIGHWAY SURVEYOR.—August 26th.—Claypole Rural District Council. £150.—Mr. A. J. Franks, clerk, 24 Lombard-street, Newark.

GAS AND WATERWORKS MANAGER.—August 28th. Devizes Town Council. £200 per annum. The Town Clerk, Devizes.

SURVEYORS' CLERKS AND DRAUGHTSMEN.—For military hutments near Salisbury. 5s. to 7s. 6d. a day.—The Commanding Royal Engineer, Heytesbury, Wilts.

SURVEYOR OF HIGHWAYS.—Peterborough Rural District Council. £125.—Mr. W. B. Buckle, clerk, 49 Priestgate, Peterborough.

TEMPORARY DRAUGHTSMAN.—Corporation of Blackburn.—Borough and Water Engineer, Town Hall, Blackburn.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WILTON.—August 12th. For the repair of a bridge, for the rural district council.—Mr. R. A. Skelton, surveyor, Wilton-road, Bemerton.

MANCHESTER.—August 17th. For clearing a site and building retaining walls and abutments, forming an inclined railway, for the Gas Committee.—Mr. F. A. Price, superintendent, Gas Department, Town Hall.

LICHFIELD.—August 17th.—For the construction of a brick and concrete culvert, for the rural district council.—Mr. C. D. Rawstron, surveyor, Station-road, Lichfield.

CARDIGAN. — For cementing and waterproofing walls, constructing new lead valleys, improvements to water supply, and general repairs to a school, for the Education Committee.—Mr. G. Dickens-Lewis, county architect, Aberystwyth.

Engineering: Iron and Steel.

SINGAPORE.—August 14th.—For the construction of a steel bridge, for the Public Works Department.—Chief Clerk, Colonial Engineer's Office, Singapore.

BARKING.—August 15th.—For the supply of extra high-tension cables, main switchgear, sub-station switchgear, and transformers, for the Electricity and Tramways Committee.—Mr. W. E. Kidner, acting engineer and manager, Electricity Works, East-street, Barking.

SHEFFIELD.—August 15th.—For the supply of materials and work required in connection with contract 186 (excavation from site of proposed cooling towers and building concrete and brick retaining-walls), for the Electric Supply Committee.—Mr. S. E. Fedden, general manager and engineer.

MANCHESTER.—August 15th.—For the supply of hoist gear, motor cage, and hoist well, for ash-handling plant, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

LIVERPOOL.—August 16th.—The guardians of West Derby Union are prepared to purchase a good, second-hand vertical boiler, of Cochran, Essex, or other approved make.—The Clerk, Brougham-terrace, West Derby-road, Liverpool.

SHEERNESS.—August 16th. For the supply of a Cornish boiler, for the Guardians of Sheppey Union.

—Mr. J. Hill, engineer, 46 St. George's-avenue, Sheerness.

SALOP. August 16th. For pulling down and rebuilding the wall and strengthening a bridge, for the county council. Mr. M. S. Stobbs, acting county surveyor, County Buildings, Shrewsbury.

SPENNYMOOR.—August 19th.—For the construction of a culvert, for the urban district council.—Mr. C. R. Spencer, surveyor, Town Hall.

LONDON.—August 22nd.—For the supply of 1,000 forged steel driving wheel tyres, and 500 forged steel trailing wheel tyres, for electric tramcars, for the county council.—Chief Offices, London County Council Tramways, 62 Finsbury-pavement, E.C.

EDMONTON.—August 23rd.—For altering and erecting ironing and other laundry plant, for the Guardians. Mr. J. C. S. Mummery, architect, 13 Fitzroy-square, London, W.

ISLE OF THANET.—August 24th.—For the supply of two wrought-iron galvanised hot-water tanks, for the Guardians.—Mr. A. E. Fussell, Hill House, Minster, near Ramsgate.

STOCKBRIDGE.—For the creation of 80 yds. of fence and 60 yds. of retaining wall, for the rural district council.—Mr. W. J. Ayles, district surveyor, Broughton, Stockbridge.

Roads.

ROMFORD.—August 14th.—For the supply of 920 tons of granite, for the rural district council.—The Highway Surveyor, 16a South-street, Romford.

JOHANNESBURG.—August 14th-15th.—For the supply of 1,600 tons of tar or tar substitute, for the municipal council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

LONDON.—August 15th.—For the supply of 370,000 creosoted deal paving blocks, for the county council.—Chief Officer, L.C.C. Tramways, 62 Finsbury Pavement, E.C.

SCUNTHORPE.—August 30th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, 110 High-street, Scunthorpe.

Sanitary.

WIGAN.—August 21st.—For the supply of 250 galvanised sanitary pans, for the corporation.—Mr. W. H. Tyrer, town clerk.

WANDSWORTH.—August 21st.—For surface water drainage works at Wandsworth Cemetery, Magdalen-road, Wandsworth, for the borough council.—Mr. P. Dodd borough engineer, 215 Balham High-road, London, S.W.

Stores.

GOSPORT.—August 10th.—For the supply of artificial stone paving, broken stone for macadamising, brooms, castings, cement, lime, disinfectants, stoneware pipes and ironmongery, for the urban district council.—The Surveyor, Town Hall.

ROCHESTER.—September 5th.—For the supply of road metal, brooms, horse hire, and tools, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

Miscellaneous.

WARSOP.—August 14th.—For laying out a portion of the new burial ground, for the urban district council.—Messrs. Vallance & Westwick, White Hart-chambers, Mansfield.

SOUTHAMPTON.—September 4th.—For dredging work in the River Itchen, for the Harbour Board.—The Engineer, Harbour Board's Offices.

Road Work for Conscientious Objectors.—Conscientious objectors are to be employed to carry out a scheme of reconstruction of the Newhaven to Seaford road, which is about to be begun at the request of the Road Board.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

21-22.—Municipal Tramways Association: Annual Meeting, Surveyors' Institution.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

O. H. M. S.

VACANCIES at Military hutments near Salisbury, for men ineligible for the Army:—

Surveyor's Clerks and Draughtsmen.

Wages 5s. to 7s. 6d. a Day.

Hut accommodation (single) provided; travelling expenses not allowed.

Apply with references, &c., to:—

THE COMMANDING ROYAL ENGINEER,
(3,064) HEYTESBURY, WILTS.

THE RURAL DISTRICT COUNCIL OF CLAYPOLE, IN THE COUNTY OF LINCOLN.

APPOINTMENT OF TEMPORARY HIGHWAY SURVEYOR, SANITARY SURVEYOR, AND INSPECTOR OF NUISANCES.

The above Council invite applications for the appointment of the combined offices of Temporary Highway Surveyor, Sanitary Surveyor, and Inspector of Nuisances for the Rural District of Claypole.

There are about 180 miles of roads and twenty-six parishes in the district.

The salary for the combined offices (which is in every respect inclusive) will be £150 per annum, and the appointment will be made for the duration of the war or until the return of the Council's permanent Surveyor, who is on military duties. The person appointed must be fully qualified and ineligible for the Army and will be required to reside in the district and to devote the whole of his time to his duties, and to give approved security in the sum of £300 for the faithful discharge of the same.

Applications, marked "Temporary Highway Surveyor," in the candidate's own handwriting, stating age, qualifications, and previous experience, and when the candidate could commence his duties, and accompanied by copies of not more than three recent testimonials, must be delivered at my office not later than Saturday, the 26th inst.

The appointments will be subject to the approval of the Local Government Board.

Canvassing members of the Council, either directly or indirectly, will be deemed a disqualification.

By order,

A. J. FRANKS,
Clerk to the Council.

24, Lombard-street, Newark.
August 8, 1916. (3,065)

APPOINTMENTS WANTED.

YOUNG Gentleman (20 years), with army discharge, requires appointment in Architect's or Surveyor's Office. Tracing, designing and clerical work. Good professional references. Apply W. E. Jefferiss, "Elm Villa," North-street, Romford. (3,060)

MACHINERY AND PLANT.

STEAM FIRE ENGINE (horse-drawn) for Sale, capacity, 800 gallons per minute; 6-in. suction and two 4-in. deliverers. Maker, R. T. Gould, New Jersey, U.S.A. Suitable for small borough or gentleman's estate. Can be viewed at Hugh Stevenson & Sons, Limited, Summerstown Works, Lower Tooting, London, S.W. (3,063)

MISCELLANEOUS.

WANTED, The Surveyor, Vols. 24 to 42 inclusive, and Vol. 44, in publishers' cases or unbound. Offers to the Publisher, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

WANTED immediately, Hire or Purchase, 6-8-ton Steam Roller; good working order.—Full particulars and lowest cash to Box 1,579, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,062)

The Surveyor

And Municipal and County Engineer.

Vol. L. AUGUST 18, 1916. No. 1,283.

Minutes of Proceedings.

Omnibus Routes.

We have already drawn the attention of our readers to the provisions of the Local Government (Emergency Provisions) Act dealing with the control of omnibus routes, but, in view of the importance of the subject, we are constrained to return to it and to say something in regard to the administrative difficulties with which it is surrounded. At first sight, sec. 20 of the Act might appear to operate to prevent, for the duration of the war and a certain period afterwards, the establishment of any new line of omnibuses without the consent either of the local highway authority or of the Local Government Board. But on consideration it becomes apparent that this is not the case. The section is certainly open to the interpretation that where a route has been regularly used by any omnibus service during the prescribed period, that route can in the future, notwithstanding the provisions referred to, be used freely by other lines of omnibuses. Again, the exemption from this part of the Act which is given to lines of omnibuses which have "regularly" used any route raises a question as to the meaning of the word which we have placed in inverted commas, which can only be authoritatively determined by the High Court.

The whole question was recently considered by the County Councils Association, and that body adopted a series of resolutions on the recommendation of their Highways Committee. The first of these resolutions expresses the opinion that it is desirable that, so far as possible, county councils should, through their Highway Committees, act in concert with and as agents for the various minor highway authorities within their area in the administration of the section. While it is certainly to be hoped that some means may be devised for securing uniformity in the administration of the Act, the "minor" highway authorities will no doubt have something to say as to the suggestion that the county councils should act as their agents in the matter. The next proposal of the association is certainly an excellent one. It is that for each county a map should be prepared by the county surveyor, in consultation with the surveyors of the minor highway authorities within the area, distinguishing the roads which are new routes within the meaning of the Act from those which were regularly used by omnibuses before the passing of the Act, and also showing which roads are in their opinion capable of carrying omnibus traffic. The value of this proposal lies in the circumstance that many omnibus routes traverse the districts of more than one highway authority. The next resolution emphasises the desirability of fostering good feeling and establishing a right understanding between omnibus owners and highway authorities by suggesting that, as far as possible, efforts should be made by county councils to get the owners of omnibuses to co-operate by friendly arrangements, rather than by the enforcement of the legal position, as to the routes which their vehicles shall use. This, of course, is the spirit in which the Act should be administered, and the general power which is given to highway authorities to attach conditions to their consent to the use of new routes ought greatly to facilitate the carrying on of negotiations.

We are not quite clear as to the meaning of the final resolution that a "consent" under the section may properly include the condition that a reasonable fee shall be paid by the omnibus proprietor. Presumably there is no general objection to the conditions imposed providing for a money payment to be applied to the upkeep of the roads, but it is surely open to doubt whether a "fee" in the strict sense of the word can be charged. In regard to contributions towards the maintenance of the roads, the opinion has been expressed by the Lancashire County Council that so very little could, in any event, be obtained under this section in the way of compensation from the motor owners for damage they do to the roads, that it is not worth consideration, especially as the Act is only temporary in its operation. With this view, however, we hardly agree. It must be remembered that highway authorities now have a unique opportunity of enforcing the principle involved—an opportunity which should not be allowed to pass unheeded. As regards the rate of payment, this must, of course, primarily depend upon the character of the road; and the following scale, drawn up by an expert for the official gazette of the association, and reckoned on the assumption of 100 miles a day, should at least afford a basis for discussion:

		Per 'bus per mile.	Per 'bus per annum.
		d.	£ s.
(*a*)	Specially constructed wood paved or asphalted road on reinforced concrete ...	$\frac{9}{8}$	57 0
(*b*)	Wood-paved road (on concrete)	$\frac{7}{10}$	66 10
(*c*)	Asphalt road (on concrete)...	$\frac{7}{10}$	66 10
(*d*)	Granite sett or Durax paved road (on concrete)	$\frac{7}{10}$	66 10
(*e*)	Asphaltic macadam road	$\frac{1}{2}$	76 0
(*f*)	Tarred slag macadam road	$\frac{3}{4}$	114 0
(*g*)	Tarred limestone macadam road	$\frac{3}{4}$	114 0
(*h*)	Tarred granite macadam road	$\frac{3}{4}$	114 0
(*i*)	Granite water-bound road	1	152 0
(*j*)	Limestone water-bound road	1	152 0
(*k*)	Other water-bound road	1	152 0
(*l*)	Partly wood-paved and partly macadamised with water-bound metalling	$1\frac{1}{10}$	104 0
(*m*)	Partly wood or granite paved and partly macadamised with water-bound metalling	$1\frac{1}{10}$	104 0
(*n*)	Partly paved with wood and partly macadamised with tarred macadam... ...	$\frac{9}{10}$	86 0
(*o*)	Partly paved with setts or Durax and partly macadamised with tar-macadam ...	$\frac{9}{10}$	86 0
(*p*)	Partly wood-paved and partly paved with setts or Durax	$\frac{7}{10}$	66 10
(*q*)	Partly paved with wood and partly with asphaltic macadam	$\frac{1}{2}$	76 0
(*r*)	Partly paved with granite setts, or Durax, or partly with asphaltic macadam or Lithofalt	$\frac{1}{2}$	76 0

It would be interesting to hear the views of our readers on the scale suggested.

Housing in Liverpool.

The activities of the Liverpool Corporation in recent years with regard to the clearance of slum areas and the demolition of insanitary houses have been on so large a scale, and the improvements that have been effected are so striking, that the question of what the conditions were before this great work was undertaken naturally suggests itself. From a very interesting article by Dr. Hope, the city medical officer of health, which appears in the current issue of the *Journal of State Medicine*, it seems that the exceptional sanitary difficulties that have had to be surmounted are due to two main causes. One is the geographical position of Liverpool as the great link between the Eastern and Western worlds, and the other is the extremely rapid commercial development of the city at a time when sanitary science, if not unknown, was impossible to apply —the result being the crowding together of squalid habitations into the narrowest possible compass, as well as burrowing into the earth to construct cellar dwellings. Some idea of the critical situation with which the corporation have had to deal may be gathered from the fact that in the early 'sixties there were occupied not less than 22,000 insanitary houses and about half that number of cellar dwellings. To deal adequately with the problem thus presented, special legislation has been necessary, and special sanitary powers have been obtained from Parliament on many occasions, the provisions of the Liverpool local Acts having in some particulars paved the way for subsequent general legislation. The nett result has been the demolition of no fewer than 20,000 insanitary houses and the almost total abolition of the cellar dwelling. In addition to this, a large number of houses have been dealt with by closing orders under the Housing of the Working Classes Acts.

Operating on such a vast scale, the problems of re-housing have had to be kept constantly in mind. The earlier policy of the corporation was not themselves to build, but to rely on wholesale demolition acting as a stimulant to private enterprise—a policy which has been justified, in part, at all events, by the erection by private enterprise during the last twenty years of some 22,000 houses. But the corporation, through its Housing Committee, has been faced with the difficulty of providing for those who appeared to be too poor to pay even a moderate rental, and who, at the same time, from the necessities of their precarious and uncertain dock labour, required to live near the docks, and they adopted the policy of making provision for the re-housing of families of this class whom they dispossessed, or who were dispossessed on sanitary grounds by the Health Committee. As Dr. Hope points out, however, a great many of the dispossessed would prefer to go elsewhere; others, of irregular habits (drunken and disorderly), clearly could not be accepted as tenants, or, if they were accepted, their tenancy was not of long duration; but a very great work has been accomplished by making adequate provision for the average labouring family, which cannot afford a high rental. This provision comprises not merely a habitation—it involves the provision of all necessary sanitary appliances, the later series of dwellings having been furnished with baths, and, not only that, but also supplies of hot water. Furthermore, the schemes have made provision for playgrounds and open spaces for the aged and young, and in every case where it was necessary the widening and opening out of the principal streets.

What, it may be asked, are the material results of these vast schemes? In the first place, practically all the slum areas have been swept away, and in their place are found decent healthy tenements, situated in wide streets, with plenty of air space and playgrounds for the children. Further, Dr. Hope states that typhus fever has wholly disappeared, and other zymotic diseases have very greatly diminished, while at the same time the habits of the people are vastly improved, and there has been a remarkable decrease in squalor, drunkenness—and what is perhaps most important—child neglect. Truly a remarkable record, and one of which the corporation and their advisers have every reason to be proud.

* * *

Highway Obstruction: Liability for Accident.

The recent decision of the House of Lords, allowing the company's appeal in the case of *Hewlett* v. *Great Central Railway Company*, will, we venture to think, come both as a surprise and a disappointment to those who looked upon the decision of the Court of Appeal (thus reversed) as an illustration of a well-established principle—viz., that any one who places a dangerous thing upon a public highway is bound to take all reasonable precautions for the protection of all persons using the highway, and that if he omits to do so he will be liable for the consequences. It will be remembered that this was an action by a taxi-cab driver for damages for injury to his cab by colliding, after dark, with a gate-post at the entrance to Marylebone Station. The gates and posts had been erected by the company without authority, but they had subsequently obtained a private Act of Parliament authorising them to maintain these obstructions. The Act contained no provision as to lighting, and the street lighting was carried out by the Marylebone Borough Council, but it was considerably diminished in consequence of the regulations made under the Defence of the Realm Consolidation Act, 1914. The Court of Appeal held that the company were liable on the ground that, although the private Act gave them authority to maintain the gates and posts, it did not absolve them from the duty of taking reasonable care for the protection of the public in the circumstances from time to time arising. So far as we can gather from the judgment of Lord Parker in the House of Lords, that House would appear to have taken the view that no such duty existed. After referring to the well-settled principle that those who exercise statutory powers must use reasonable care to prevent any injury which was likely to be occasioned by their exercise, his lordship said that the only statutory power the company could be said to have been exercising was the power to "maintain" the gates and posts. "What," he continued, "was the meaning of the word 'maintain' as there used? Negatively it released the company from any obligation which might otherwise have existed to remove the posts; positively it enabled the company to do what was necessary to keep the posts there. It was only in its negative aspect that the company could be said to have exercised this power. It had in fact done nothing at all. In his opinion the principle relied on had no application in such circumstances. For it to be applicable the company must be doing something involving risk to others without taking reasonable precautions to avoid such risk." Thus the very fact which in the opinion of the Court of Appeal entailed liability on the company—namely, that they "did nothing"—was held by the House of Lords to absolve them from liability.

With the utmost possible deference to so high an authority we would venture to suggest that there is something fallacious in this line of reasoning. It is perfectly true that, so far as concerns precautions, the company "did nothing;" but, as his lordship was careful to state, they did exercise their statutory power of "maintaining" obstructions which, in the absence of such statutory power, would have been an illegal nuisance, and this, surely, was, in his lordship's own words, "something involving risk to others," and it was admittedly done "without taking reasonable precautions to avoid such risks." The distinction

drawn between the "positive" and the "negative" meanings of the word "maintain" appears to us to be somewhat over subtle, and does not appeal to us.

* * *

Diagrammatic Statistics.

The use of charts and diagrams for various municipal purposes is becoming very general. Just as graphic statics are found safer and more convenient in constructional work than mathematical calculations, so do the charts and diagrams show more readily the records and result of the working of any particular department. They enable the surveyor to see at a glance the costs over a number of years, and so detect the weak spots in his work. By paying greater attention to those particular items which indicate a want of supervision, lack of attention, and due regard for economy, he can often materially reduce his working costs. The paper by Mr Reginald Brown on the subject of "Diagrammatic Statistics," which appears in this issue, contains a number of useful diagrams of a standard character which can be applied to the working of the various branches of his department. Thus the charts given in Mr. Brown's paper show the costs graphically for the removal and disposal of refuse, sewage disposal, house refuse collection and disposal, pumping, highways maintenance, scavenging and watering, and baths. A systematic tabulation of results and costs relating to highways and sewers should be found in every surveyor's office. So also should a complete set of plans of his district, kept up to date, showing the positions of all sewers, manholes, flushing tanks and vent shafts, together with a book of sections giving the size, inclination, velocity and discharging capacity of the sewers. Method is very necessary, but one frequently finds it made a hobby which is ridden to death. The numerous reports issued by our Government offices, in the opinion of many men, go into a great amount of unnecessary detail at a great expenditure of time and money, and just recently we have seen these red-tape methods coming in for severe criticism both in Parliament and the Press. Figures are said to be able to prove anything, and in the hands of an astute politician (and we may include many chairmen of municipal finance committees in this category) they are certainly very often made to convey a meaning exactly contrary to that read into them by the man in the street. Charts and diagrams are not open to this criticism, at any rate to the same extent, but even standard charts if not used with due discrimination and a proper regard for local considerations may frequently be misleading. By allowing comparisons to be so readily made between a number of towns, probably differing greatly with regard to the cost of labour and materials, there is a danger that they may sometimes cause trouble to the surveyor. Another difficulty experienced by many surveyors—we might say most at the present time—is that, however desirable they may consider it to be to have these various charts, they are so badly understaffed that they have no time to prepare them. This is particularly so in the smaller districts, where the surveyor's time is fully occupied by the ordinary routine work of his department, making him look upon these charts and diagrams as part of a policy of perfection which can only be carried out with an efficient staff in a large office.

* * *

The Cowlyd Water Board Bill.

An interesting position has been evolved from the Cowlyd Board Bill, which recently passed its third reading in the House of Commons. The Bill in brief provides for the enlargement of Cowlyd Lake. At present the water supply for Colwyn Bay and the other parts of the area of the Conway and Colwyn Bay Joint Water Supply Board is obtained from the lake. Under the powers conferred by the Bill a private business concern will undertake to enlarge and deepen the lake considerably, and will share with the board the additional water thus stored. When the subject was discussed at the Colwyn Bay Urban District Council on Monday night, the chairman, Mr. W. Horton, who is a member of the Cowlyd Board, announced his resignation as a member of the special sub-committee of the body which had charge of the Bill. Mr. Horton's complaint was that his suggestions for the improvement of the Bill had been ridiculed and swept aside. What these suggestions were precisely is not stated, but it is to be inferred from the discussion that they had some relation to the root principle of the Bill namely, the participation of a business concern in the scheme promoted by the Cowlyd Board. At all events, a member, apparently by way of reply to Mr. Horton, predicted that future generations would have occasion to bless the step taken by the board, for it provided ample water for the district if it trebled in size for the next century, and the whole without a penny of expense. On the other hand, it was contended by another speaker that the board had sold its birthright for a mess of pottage, while the clerk of the urban council, Mr. Amphlett, declared that the Cowlyd Board had been very ill-advised in accepting the Bill, and that they had given away the Cowlyd watershed "for nothing." The board, he continued, did not own a drop of water above the present level of the dam. Every drop above that level belonged to the company, who could do as they liked with it. This kind of talk, if it has any real basis, is disconcerting, not to say alarming, and the question may be asked how it should arise as an eleventh-hour warning after the Bill has passed its third reading in the House of Commons. It seems almost incredible that public interests should have been sacrificed to private ends in the wholesale manner here suggested, and we are forced therefore to the conclusion that the judgment of the critics is based upon considerations only remotely connected with the Bill itself.

* * *

Housing in 1915-16.

In another column will be found a summary of that part of the report of the Local Government Board for 1915-16 which deals with the subjects of housing and town planning. The keynote is the restriction of activities in every direction which has been rendered necessary by the war—a restriction which has been generally countenanced, if not directly encouraged, by the board. For example, in regard to the duty of systematic inspection under sec. 17 (1) of the Act of 1909, the board are content mildly to suggest that they trust that local authorities will take all reasonable measures for inspecting and dealing with houses that present an immediate and serious danger to health. It is common knowledge that since the outbreak of war the provision of new working-class housing accommodation either by local authorities or by private enterprise has practically ceased, and a serious problem has in consequence arisen for solution when hostilities cease. In this connection it is at least satisfactory to observe that the matter has been engaging the serious attention of the board for some time. Some loans have been sanctioned during the year under review, but in every case save one the houses to be provided were urgently wanted in connection with war requirements, and in several of them the schemes were the outcome of consultation with the local authorities concerned, undertaken by the board on behalf of the Admiralty or the Ministry of Munitions, who, in view of the extraordinary conditions and the abnormally increased cost of building, secured grants from Imperial funds towards the cost of the schemes. In regard to town planning, too, there has been but little progress.

Housing and Town Planning.

LOCAL GOVERNMENT BOARD REPORT FOR 1915-16.

Part II. of the forty-fifth annual report of the Local Government Board, which relates to housing and town planning, and covers the twelve months ended March 31st last, was issued this week.

Owing to the war there has, naturally, been a very marked diminution in the activity of local authorities generally in housing matters, and the board have not regarded it as expedient, in the circumstances, to undertake much of the work which they would have felt called upon to perform in normal times, or to bring pressure to bear upon local authorities, except in very special cases.

HOUSING INSPECTION.

The board have continued to receive copies of the annual reports of medical officers of health, but in view of the position created by the war it has not been practicable to take such action upon them as regards housing matters as would otherwise have been done in many instances. It has been observed from the reports that in some districts, owing to depletion of staff and other causes, the inspection required by sec. 17 (1) of the Act of 1909 has considerably slackened, and in a few cases has ceased altogether. Although the board recognise that a reduction in the number of houses inspected was, in the circumstances, inevitable, and that it is expedient as far as possible to avoid resorting to the making of closing and demolition orders, they trust that local authorities will take all reasonable measures for inspecting and dealing with houses that present an immediate and serious danger to health.

IMPROVEMENT SCHEMES.

As regards action in respect of improvement schemes under Part I. of the Act of 1890, the report says:

"The clearance of insanitary areas under the provisions of improvement schemes necessarily involves the acquisition of a considerable amount of property, frequently including trade interests and property not in itself of a specially insanitary character as well as much that is insanitary, and it is usually therefore an expensive process. It may be stated generally that, in response to the appeal of the Government for the restriction of the expenditure of local authorities within the narrowest possible limits, schemes of this nature which are in course of execution and which cannot, having regard to the existing obligations of the authorities concerned, be altogether suspended are being proceeded with as slowly as is practicable."

LOCAL AUTHORITIES' RETURNS.

Although application was made as usual for the account which every local authority is required by sec. 44 of the Housing of the Working Classes Act, 1890, to submit annually as to its proceedings under Part II. of that Act, and for the statement which the board usually obtain at the same time as to action taken by the authorities under sec. 15 of the Housing, Town Planning, &c., Act, 1909, it was felt that the information could not reasonably be pressed for. As a result, in nearly 300 cases the account or the statement in question was not received, and any useful comparison of the figures with those for former years is therefore out of the question. The particulars furnished by the remaining 1,500 authorities, however, show that during the year ended March 31, 1915, no fewer than 42,728 houses were satisfactorily repaired after notice under sec. 15 of the Act of 1909, 13,603 houses in respect of which action had been taken under sec. 17 of that Act were made fit for human habitation by the owners without the issue of closing orders, and 2,775 houses were made fit by the owners after the issue of closing orders. With a view to economy, and having regard to the circumstances prevailing, the board have decided not to ask for the account and statement in question in respect of the year ended March 31, 1916.

EFFECT OF THE WAR UPON BUILDING ENTERPRISE.

In their previous report the board pointed out that, speaking generally, the war had necessitated the postponement of the provision of working-class dwellings by local authorities, and that the shortage of labour, the increased cost of certain building materials, and the increasing difficulty of financing building operations had at the same time tended to restrict the building of such dwellings by private enterprise. Since that report was written the restrictive effect of the war on building has become still more marked, and it is feared that in many districts in England and Wales there exists, or will exist on the conclusion of the war, a very serious need for additional accommodation for persons of the working class. The provision of this accommodation will involve difficult problems, and the matter has been engaging the serious attention of the board for some time.

During the year under review the board sanctioned the borrowing by twenty-four local authorities of sums amounting in all to £502,904, for the purposes of Part III. of the Act. Of this, £5,171 represented the total of small loans sanctioned to fifteen local authorities for the purpose of meeting excess expenditure on schemes which had been already executed or of defraying expenses actually incurred in connection with the acquisition of land or the preparation of schemes subsequently postponed on account of the war. As regards the remainder of the total amount sanctioned, £462,930 was required by six urban authorities for the purchase of approximately 108 acres of land and the erection of 1,917 houses or tenements, and £34,803 by three rural district councils for the purchase of some 14 acres of land and the erection of 154 houses. The rent proposed to be charged varied from 4s. to 13s. 6d. per week.

In all of these nine cases, except one, where a small loan of £800 was sanctioned under special circumstances to a rural district council early in the year, the houses to be provided were urgently wanted in connection with war requirements, and in several of them the schemes were the outcome of consultation with the local authorities concerned, undertaken by the board on behalf of the Admiralty or the Ministry of Munitions, who, in view of the extraordinary conditions and the abnormally increased cost of building, secured grants from imperial funds towards the cost of the schemes. The amount of the grant varied according to the circumstances of each particular case, but in no case exceeded 25 per cent of the cost of the scheme, and in every instance the contribution was conditional upon the reservation of the dwellings, for a certain fixed period, for the employees in whom the department concerned was more particularly interested.

In one of the cases in which a grant was agreed to be made the scheme has since been abandoned, and the sanctions to the loans have been cancelled. In another instance it was arranged that a firm of manufacturers should contribute £10,000 towards the cost of a scheme for the erection of dwellings.

TOWN PLANNING.

As in the case of housing, so in regard to town planning, the deterrent effect of the war is evident. Many local authorities who had been actively engaged in preparing town planning schemes, or considering proposals for schemes, have been compelled to curtail their consideration of the matter owing to seriously depleted staffs. Although in some respects the time might be regarded as favourable for the preparation of schemes, the board have not considered it desirable to press local authorities unduly to go forward with their schemes; at the same time, they think it is very desirable, in view of probable developments after the war, that local authorities should take every possible opportunity to advance their schemes, in order that when the opportunity for building occurs progress with building operations may not be impeded.

During the year to which the report relates, the board gave authority for the preparation of eighteen schemes by following seventeen local authorities in respect of areas containing more than 40,000 acres of land—namely:—

Corporations (9) (ten schemes): Birmingham, Colne, Croydon, Leeds, Mansfield, Newport (Mon.), Nottingham, Sheffield, Southend-on-Sea (two areas).

Urban district councils (6) (six schemes): Beckenham, Bentley-with-Arksey, Little Hulton, Longbenton, Seaton Delaval, Whitley and Monkseaton.

Rural district councils (2) (two schemes): Grimsby, Wrexham.

In addition to the cases above mentioned there

were under consideration at the end of the year eleven applications by ten local authorities for authority to prepare schemes in respect of areas comprising about 29,000 acres of land.

Corporations (4) (four schemes).—Salford (2,290 acres), Sheffield (142 acres), South Shields (2,454 acres), West Hartlepool (5,332 acres).

Urban District Councils (5) (six schemes).—Bredbury and Romiley (two areas of 3,986 and 164 acres), Cheadle and Gatley (4,232 acres), Earsdon (4,574 acres), Hale (1,010 acres), Southgate (2,980 acres).

Rural District Council (1) (one scheme).—Wrexham (2,251 acres).

In some of these cases authority to prepare schemes has since been given.

Preliminary notices have, in addition, been given under the Regulations by the following twenty-five local authorities with a view to application being made to the board for authority to prepare schemes—viz.:—

Corporations (11).—Birkenhead, Chesterfield, Chorley, Coventry, Derby, Middlesbrough, Ramsgate, Reigate, Sheffield, Shrewsbury, South Shields.

Urban District Councils (10).—Acton, Barnes, Barry, Chiswick, Finchley, Hayes, Hendon, Wembley, Willesden, Wood Green.

Rural District Councils (4).—Doncaster, Eastry, Tadcaster, Warrington.

In a large number of other cases the information in the board's possession would seem to indicate that the consideration of the matter by the local authority has reached a stage practically equivalent to a decision to proceed with a scheme, and in numerous other cases the board are aware that the question of preparing a scheme has been under consideration. In many instances, however, the matter has been deferred during the present emergency.

ROAD SURFACES FOR MOTOR TRAFFIC.

ELECTRIC VEHICLE TESTS.

Last year some interesting experiments were carried out by Dr. A. E. Kennelly and Mr. O. R. Schurmer, of the Massachusetts Institute of Technology, into the properties of various types of road from which the importance of smooth surfaces for motor vehicle operation are emphasised. The tests were made with an electric delivery wagon weighing under half a ton, and equipped with solid tyres, roller bearings, worm drive and differential gearing. Before being placed on the roads, laboratory tests were carried out to determine the mechanical efficiency of the machine, from the battery terminals to the wheel rims, and this proved to be between 70 and 75 per cent. Some of the chief results have been published in the *Electrical World*.

On tar-macadam in good condition and wet the tractive resistance east-bound varied from 27 lb. per ton, at 12 miles per hour to 30 lb. at 15·5 miles per hour; west-bound, the tractive effort varied between 20 lb. per ton at 10 miles per hour and 24 lb. at 14 miles per hour. On an asphalt road in fair condition, the tractive effort ranged from 20 lb. per ton at 10 miles per hour to 24 lb. at 15·5 miles per hour. With the asphalt in poor condition, the tractive effort was increased about 10 per cent. Eliminating the air resistance, a constant tractive effort of 17 lb. per ton was required between 10 miles per hour and 15 miles per hour on asphalt pavement.

On wood block paving in good condition the tractive effort ranged from 22 lb. per ton at 10 miles per hour to 24 lb. at 14·5 miles per hour. In general, eliminating wind effect, the resistance of wood block paving was about 15 per cent greater than that of asphalt. Brick paving in good condition showed a slight increase in resistance over the wood blocks, and with the bricks slightly worn the resistance ran up somewhat higher. Tar-macadam in good condition showed about the same resistance as an ordinary water-bound macadam with a fine surface in good shape. A 50 per cent increase resulted from a macadam road in poor condition through holes. The resistance of heavily-oiled macadam roads was rather high, and between 7 and 13 miles per hour on a freshly-tarred soft road the resistance varied between 32·5 lb. and 35 lb. per ton.

Gravel and cinder roads showed about 10 or 15 per cent more resistance than good macadam. Granite-block paving proved to be the worst road for mechanical traction, a road of this type on a concrete base, but with sand and gravel interstices, showing two and a half times the resistance of asphalt or wood blocks, the resistance of a granite block road with cement joints being about 60 per cent greater than that of asphalt. With a granite road the resistance increases with speed when the still air resistance is eliminated due to impact resistance. Asphalt, as stated, gives a straight-line curve of tractive effort and speed between 10 and 15 miles per hour.

The results, it is pointed out, generally confirm previous experience, and it would be interesting to extend them to cars fitted with pneumatic tyres, the results from which would no doubt be better on the granite-block paving than were obtained with solid tyres.

RAND WATER BOARD.

VAAL RIVER SUPPLY: A MODIFIED SCHEME.

The original Vaal River Scheme, adopted by the Rand Water Board in 1913, and of which a description appeared in THE SURVEYOR of December 24th last, provided for the erection of a barrage to impound a quantity of water sufficient to supply 20,000,000 gallons a day for the Board's purposes. It was proposed, however, to take, in the first instance, only 10,000,000 gallons daily, and the plans and estimates originally framed by the Board's Chief Engineer, Mr. W. Ingham, M.INST.C.E., M.I.MECH.E., included the plant and machinery necessary to deal with that quantity of water. The estimated cost was £1,250,000, of which £1,146,707 was for engineering. The estimated working costs were 4·376d. per 1,000 gallons, or a total, including the annual fixed charges, of 8·965d. per 1,000 gallons pumped to the Rand.

The preliminary arrangements in connection with the commencement of the scheme referred to above had been made by July, 1914; the outbreak of the European war on August 1st following, however, made it quite impossible for the Board to raise a loan. The immediate accomplishment of the Board's purpose having been thus defeated, the important question shortly afterwards arose what measures, if any, could be adopted to prevent the difficulty likely to be experienced in keeping pace with consumers' demands during the war period, and until a loan could be raised and the Vaal River scheme completed. During the three previous years the rainfall on the Rand and in the Transvaal generally was very scanty, and on many occasions during that period the interests of the towns and mines supplied by the board suffered severely, owing to the inability of the board to meet their full requirements. In order to prevent a recurrence of this undesirable state of affairs, investigations have been carried on with the object of obtaining further temporary supplies, as an insurance against a shortage, during the late winter and early summer months of each year. Out of these investigations arose a proposal to borrow from the board's redemption fund sufficient money to construct a modified Vaal River scheme, which would provide such a supply of water as would be likely to secure the board's consumers against a shortage for some years to come. On enquiring further into this proposal from the engineering, financial and legal points of view, it was found practicable and was adopted by the board in March last, subject to certain minor reservations.

This modified scheme provides for the erection at the Lindique site of the barrage designed in connection with the original Vaal River scheme for impounding a quantity of water sufficient to supply 20,000,000 gallons a day, but it is proposed only to instal plant and machinery for pumping and otherwise dealing with a first instalment of about 5,000,000 gallons a day.

ESTIMATED COST.

The cost of this modified scheme, as estimated by the chief engineer at the prices ruling in November, 1915, is £770,843, including interest on cost during construction, about £39,000; an amount of £13,000, the value of pipes in stock; and approximately £42,000 already expended on the collection of data, legal and Parliamentary expenses, the erection of measuring weirs, and on other minor works and services classified under the head of preliminary expenses.

The annual working cost for the scheme is estimated at 4·6d. per 1,000 gallons, as compared with 4·376d. per 1,000 gallons for the 10,000,000 gallons per day scheme.

Diagrammatic Statistics for Municipal Engineers.*

By REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I., F.R.SAN.I., Surveyor and Engineer to the Southall-Norwood Urban District Council.

The author puts forward this paper with a certain amount of hesitation, as the subject is too wide to be dealt with as fully as it deserves in a small compass, but he offers no apology for introducing it for discussion among his colleagues, as it is a subject which is of interest to the whole of the profession, and probably no more suitable time can be found for its presentation than at an annual meeting of the institution.

The use of diagrams or charts to show at a glance the records and results of any particular department is invaluable, as by their use it is possible to gain a considerable amount of information with greater facility than by comparison of mere figures only. Such a method also enhances collective information, because of the facility in detecting inconsistencies requiring remedy.

To the individual municipal engineer the use of charts in his own work must, to say the least, be of benefit; but if standard charts could be devised by which comparisons with other towns could be made, possibly their value would be much increased, especially if the information contained therein is combined with the knowledge of the conditions under which the chart has been produced.

Unfortunately, there is a total absence of a set of general standard charts in the municipal engineering profession, but it does not stand alone in this respect by any means.

It would make this paper too long to put before the members the whole series of charts, &c., designed and used by the author for record purposes, and he must therefore content himself with dealing with the subject in somewhat of a general manner, giving a few examples showing how information can be conveyed pictorially, and trusts that quite sufficient will be said to form a basis for destructive and constructive criticism.

GENERAL.

The author has been in the habit for many years—and he is not alone in this respect—of keeping an accurate record of the costs incurred in the various branches of his department, and consequently can at a moment's notice ascertain how and why the costs have varied from year to year. This not only necessitates—in showing the particulars pictorially—the main headings for each year, but also charts for each heading containing the items making up the total of the heading, and although this involves a certain amount of labour, the advantages gained more than compensate for the trouble taken.

As an example of his meaning, the author has (in Fig. 1) selected certain divisions of his department and given the comparative costs, &c., for five years, not only in chart form, but combined with detail figures—a combination which he considers to be of greater value than a mere chart or figures only. A glance at such a chart as this will direct one's attention to the abnormal increase or decrease in expenditure in any year in any particular department, and will cause the municipal engineer to inquire further the reasons of such increase or decrease.

The author has chosen, at random, removal and disposal of house refuse (dusting) and sewage disposal as examples of the information which can conveniently be shown by charts, it being understood that other departments can be treated in a similar manner.

DUSTING.

As previously stated, to read a chart properly one must understand the conditions under which the chart has been constructed. Thus, in the author's district, the work of "dusting" is carried out on the principle of "direct labour and contract." The district is divided into five sub-districts, which are attended to by two men and horse and cart. One of the men is employed direct by the council, which provides a "two-yard" covered cart, the other man with horse and harness being provided under contract at a "rate per day." The refuse is carted to shoot, but this matter is referred to hereafter in discussing details.

Chart 1 shows there has been a great increase in the cost of this work during the five years under review, but does not convey any idea of the items which have caused the increase. To do this Chart 2 is

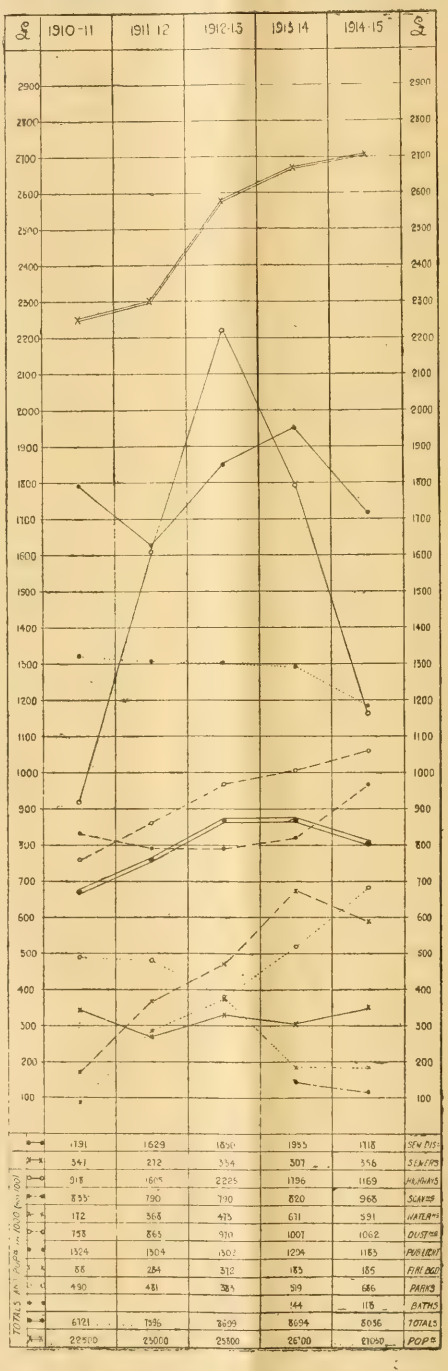
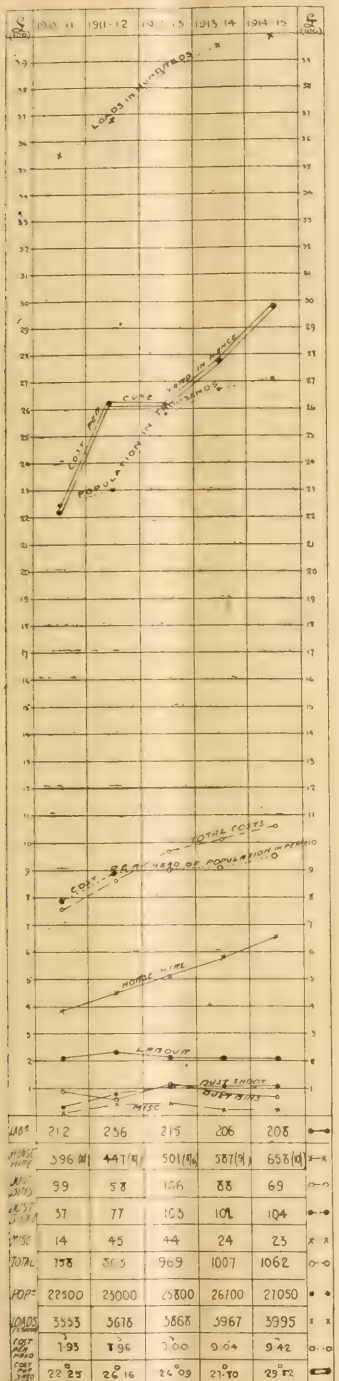


Fig. 1.—Showing Costs of Various Departments.

*(Paper submitted at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

required, and this at a glance will show that the increase has largely taken place in two items—viz.,



	1910-11	1911-12	1912-13	1913-14	1914-15
LABOUR	212	236	215	206	208
HORSE HIRE	396 (11)	447 (9)	501 (6)	587 (9)	658 (10)
DUST BINS	99	58	106	88	69
DUST SHOOT	37	77	105	101	104
MISC.	14	45	44	24	23
TOTAL	758	863	969	1007	1062
POP.	22500	23000	25800	26700	27050
LOADS (¼ YARD)	3553	3618	3868	3967	3995
COST PER HEAD	1·93	1·96	2·00	2·04	2·42
COST PER YARD	22·25	26·16	24·09	27·10	29·72

Fig. 2.—Removal and Disposal of House Refuse.

cost of shoot and horse hire. A study of the items separately will be of interest.

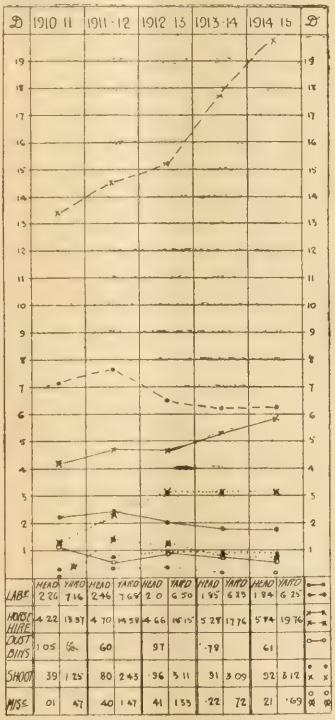
LABOUR.

In spite of the fact that the population has increased, and hence the number of loads removed, the labour item remains practically the same, and the cost of removal on this item is probably carried out as economically as possible under the circumstances. Chart 2B shows that in labour the cost per head of population has been reduced by ·42d., and if represented by yards by ·91d.

HORSE HIRE.

The charge for horse hire has gone up considerably. In 1910-11 the price paid per day for horse and man was only 8s., whereas in 1914-15 it had increased by 25 per cent to 10s (1915-16 the charge is 13s. per day). The effect of this upon the cost of removal is such that—as shown in Chart 2B—the charge per head of population and per cubic yard has increased from 4·22 and 13·37 respectively in 1910-11 to 5·84 and 19·76 respectively in 1914-15.

Obviously, however, this cannot all be due to the charge per day for horse hire, as the rate has only increased 25 per cent. while the cost per yard has increased more than 50 per cent. Hence part of the



	1910 11		1911-12		1912 13		1913-14		1914 15	
LABR	HEAD 2 26	YARD 7 16	HEAD 2 46	YARD 7 69	HEAD 2 0	YARD 6 30	HEAD 1 95	YARD 6 25	HEAD 1 94	YARD 6 25
HORSE HIRE	4 22	13 37	4 70	14 39	4 66	14 15	5 28	17 76	5 84	19 76
DUST BINS	1 05	3 16	60		97		·78		61	
SHOOT	39	1 25	80	2 45	·36	1 11	31	1 09	92	3 12
MISC	01	47	40	1 47	41	1 35	·22	72	21	·69

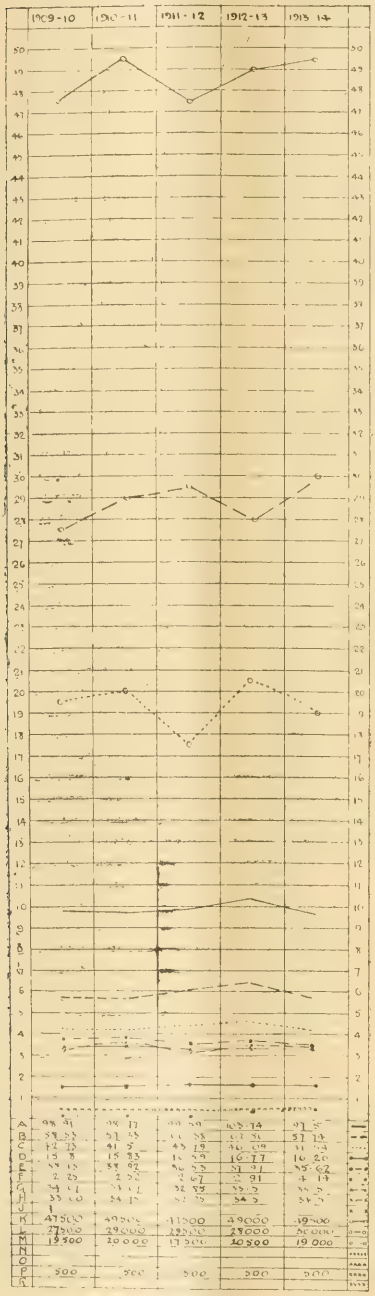
Fig. 2B.

increase is due to some cause outside this—viz., extra horse hire due to longer distance of cartage to shoot. As 3¼d. per yard is paid for "shooting" refuse in a brickfield outside the district, Chart 2B shows clearly it was not until 1912-13 that practically all the refuse was disposed of in this manner, in previous years the shoots being "haphazard" ones. The extra cost of cartage is a very serious one, as it is entirely due to distance of shoot (the ordinary labour being the same) and extra charge for horse hire.

The obvious conclusion is that if the amount is to be reduced some other and cheaper method of collection (cartage) must be adopted, if possible, and the authority carry out the whole work by direct labour. One other interesting fact may be mentioned. The author's authority has for many years past provided portable dustbins to each house at the cost of the general ratepayer. The charts show the cost to be very moderate, the average per head of population per annum being ·80d., or, say, 4d. per house of five persons, and, considering the first cost of the bins to be 4s. 5d. each, the average life of each bin may be taken as thirteen to fourteen years. The actual life of a bin, of course, depends upon the care with which it is used; some bins in the author's district have

been in use more than twenty years, and are still in good condition.

As the number of loads of refuse is carefully



Explanation.

A to F—In pence per load. G—In pence per ton. H—In pence per ton. A to H—Marginal × 10. K to P—Marginal No. × 1,000.

A—Total cost collection and disposal. B—Collection only (including collectors, shooters, horse and stable, proportion of clerks, &c.). C—Cost collection (horse and stable only). D—Cost Collection (B C). E. Cost disposal (all shoots). F—Cost other charges. G—Barge rates. H—Rail rates. J— (——). K—Total loads collected and disposed of. L Total loads collected and disposed of by barge. M—Total loads collected and disposed of by rail. N—Total loads collected and disposed of by destructor. O—Total loads collected and disposed of to chargeable shoots. P—Total loads collected and disposed of to free shoots. R (——).

Fig. 3.—House Refuse Collection and Disposal.

checked, it may interest the members to know the amount of refuse made per head per annum:—

In 1910-11, 8·53 cub. ft.
In 1911-12, 8·63 cub. ft.
In 1912-13, 8 cub. ft.
In 1913-14, 8 cub. ft.

The results are consistent with the growth in population. The author thinks, however, that the slight decrease is due to the gradual increase in the use of the "gas cooker" in the summer and the greater care experienced by the householder in burning all combustible material in the kitchener in the winter months; this is evidenced by careful observation of the class of material removed, and the record uniform number of loads removed each week.

As another and probably better illustration, the

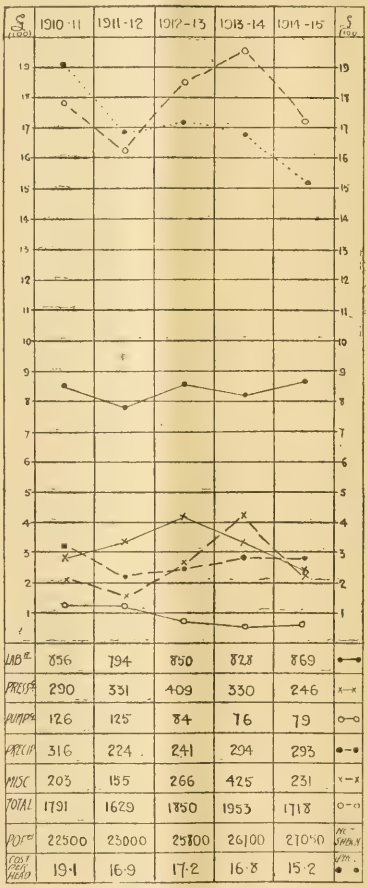


Fig. 4.—Cost of Sewage Disposal.

author is able to give, by the courtesy of Mr. W. Oxtoby, M.Inst.C.E., the borough engineer of Camberwell, a valuable chart (Fig. 3) showing the various particulars relating to house refuse as obtainable in that district. The diagram speaks for itself.

Sewage Disposal.

At how many, or rather at how few, sewage works are proper and complete records kept? And yet how much of a correct understanding of the economical and efficient disposal of sewage depends upon accurate records and statistics. It ought to be possible to know the exact amount of sewage, &c., received at a works and how the whole is treated. To do this efficiently entails a great deal of labour, but when once a system has been adopted and methodically followed the labour is minimised.

In Chart 4 the author gives a "cost" diagram of the main items covering a period of five years, but to show all the details as to the variations in the amounts each year, and their importance, it is neces-

sary to have separate detail charts for each item. Thus the cost of "pressing" in the chart (4) does not include labour, but it includes press cloth, lime used for pressing, and gas used by engine compressor, and the detail diagram would show the proportion of these together with the amount of sludge pressed and the cost per ton, together with other useful information.

Again, as to pumping, in the chart (4) the item does not include labour, but only the cost of the gas consumed (the great reduction is due to the installation of a new, more modern and economical type of engine in 1912-13). A detail chart of pumping operations would also show the number of gallons lifted and the cost per 1,000,000 gallons.

For precipitation the item in the chart (4) includes only the cost of the necessary precipitants—the detail chart would give the cost of each kind of precipitant used, together with the varying prices of same.

There is, however, not only the costs to be considered, but also the necessary records and diagrams showing the working of each department. Under this latter head a few details may not be out of place.

The author has in use a diagram which shows the various known processes of purification of sewage, and as a similar diagram can be utilised to show the method in use at any other works, he offers this suggestion to his colleagues. Such a diagram the author suggests might be in the form shown in Chart 5.

Owing to the difficulty and expense of reproducing colours the chart has had to be printed in black lines and characteristic marks only. (In the original chart colours are used.) Such a diagram shows at a glance the information desired. At the works chosen for illustration the sewage is delivered both by gravitation and pumping. The latter is only a small item, and evidently consists of domestic sewage, with the addition of a small quantity of rain water during storms.

The inflow from gravitation consists principally of domestic sewage, but there is a fair proportion of subsoil water and some trade wastes, and rain water in

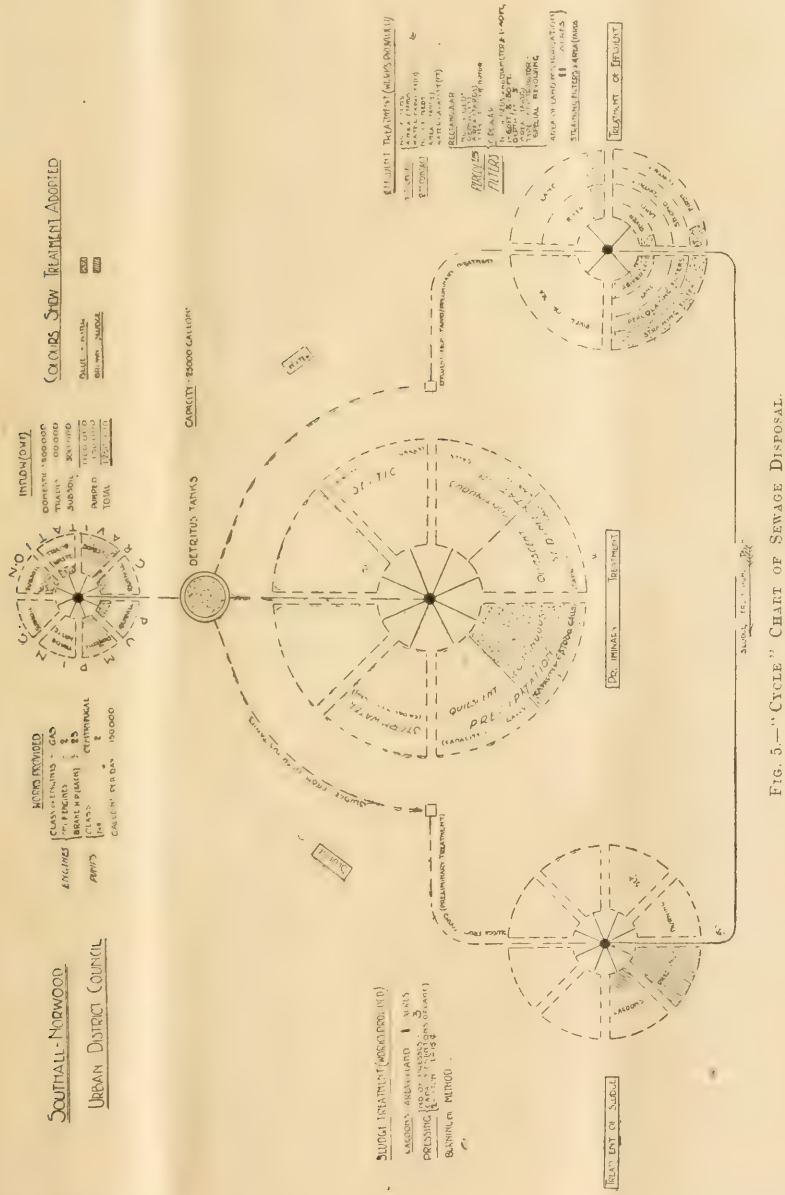


Fig. 5.—"Cycle" Chart of Sewage Disposal.

times of storms. The preliminary treatment is by detritus tanks, continuous precipitation and quiescent sedimentation, the main portion of effluent being treated through straining filters and percolating filters, although small portions are treated through first contact and land, and land only.

The main treatment of the sludge is by pressing.

main items of the treatment adopted. To have proper details, records and charts should be kept showing the rainfall, the maximum and minimum temperatures, the duty of the engines, pumps, &c., the cleansing of the various tanks, the amount of sludge produced, the duty of the filter presses (if any), the flow at various periods and places, the treatment

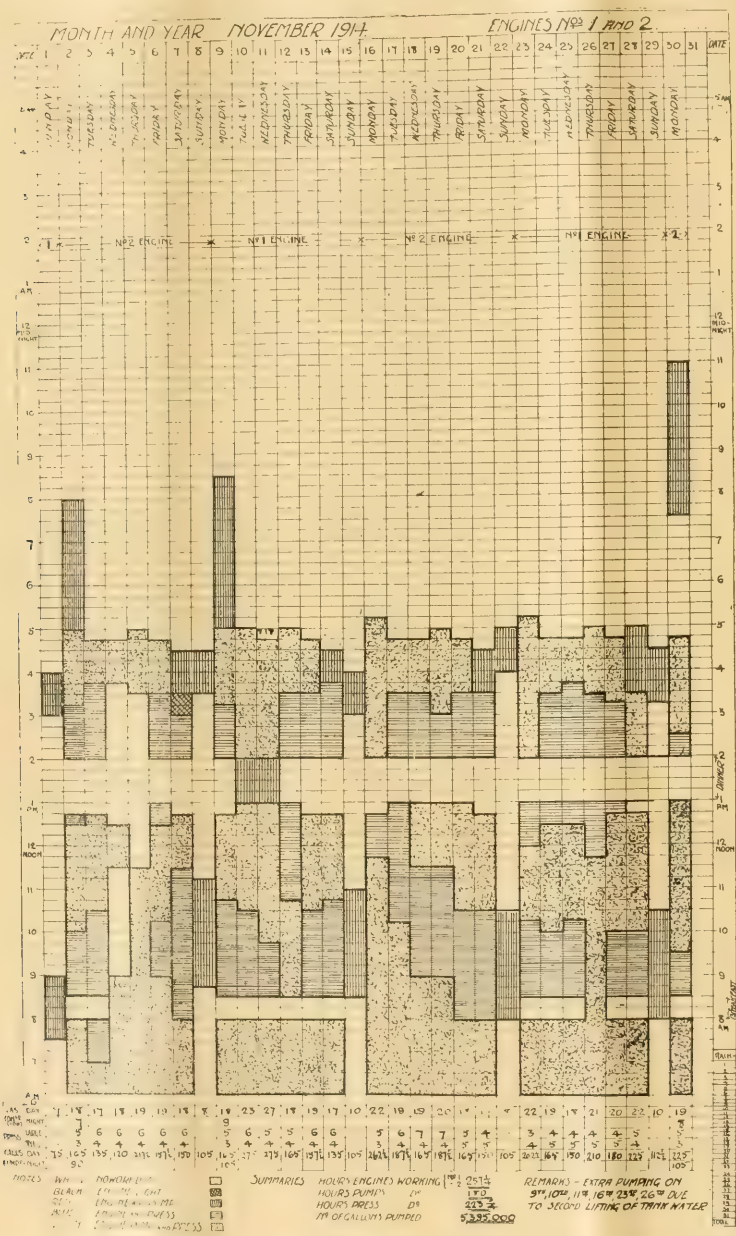


Fig. 6.—Monthly Record of Hours during which Engines, Pumps and Presses are at Work, Gas Consumed, &c.

while a small amount is dealt with in lagoons and on land.

A humus tank is also in use.

From a brief inspection the members will see how the diagram can be made applicable to their own works.

The diagram does not by any means show all the information required in an up-to-date sewage works, and it is not intended to do so, but it does show the

adopted, and the results of the various steps in the process of purification, as well as the final results of treatment before discharge into a stream.

The author gives in Chart 6 a diagram kept by him to show the times of pumping, &c., from which much interesting information may be gained.

SEWERAGE.

Every municipal engineer should, of course, have

a correct plan of the sewers and surface-water drainage of his district, showing the positions of the manholes, lampholes, flushing tanks, flushing valves, vent pipes and such like, together with the sizes and incli-

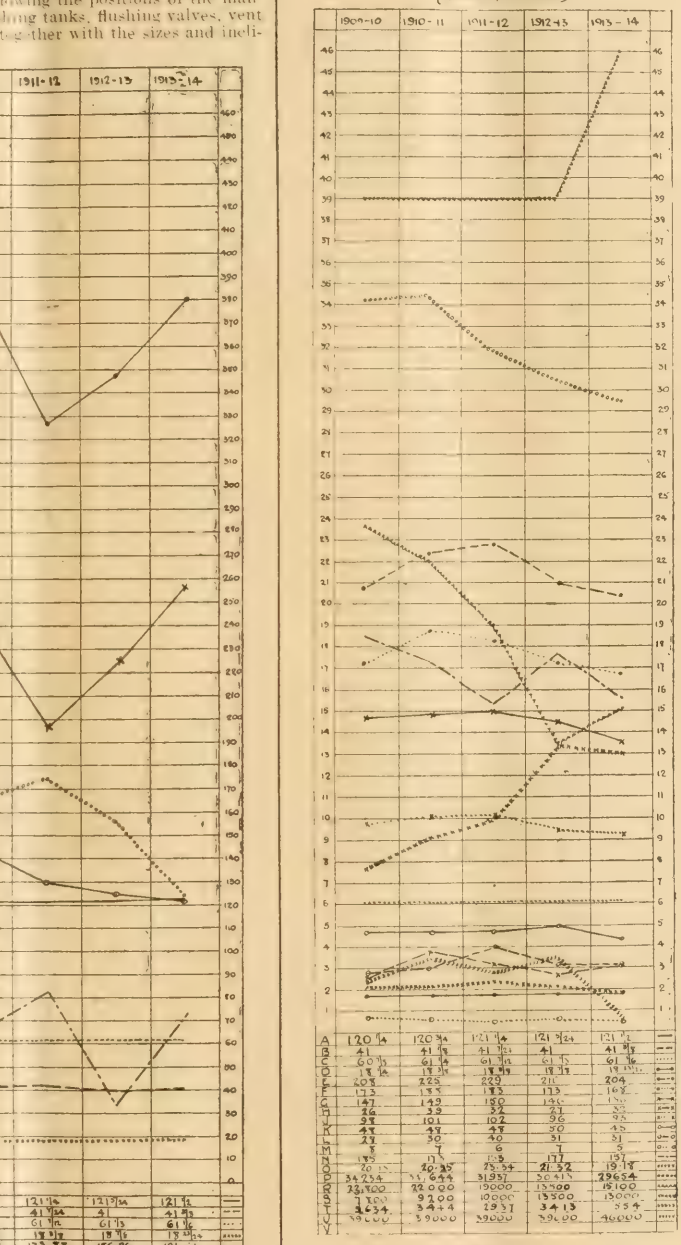
	1909-10	1910-11	1911-12	1912-13	1913-14
A	120 5/8	120 3/4	121 1/4	121 3/4	121 3/4
B	41	41 1/8	41 1/4	41	41 1/8
C	60 3/8	61 1/4	61 1/8	61 1/8	61 1/6
D	18 1/4	18 3/4	18 3/4	18 3/4	18 3/4
E	212.65	169.50	173.88	156.96	121.61
F	63.22	60.03	74.05	33.40	31.96
G	558	588	527	527	370
H	204	244	197	222	254
J	195	144	130	125	121

Explanation.

A—Total mileage of roads. B—Mileage macadam roads, granite. C—Mileage macadam roads, flints. D—Mileage macadam roads, paved roads (wood, asphalt, setts). E—Cube yards of granite per mile of granite roads. F—Cube yards of flints per mile of flint roads. G—Total cost per mile in pounds (all charges). H—Cost per mile in pounds (revenue account). J—Cost per mile in pounds (capital account).

Fig. 7.—Highways Maintenance (Mileage and Costs).

nations of each and every length, and the invert levels at every manhole or at every change of direction. Besides the plan, records would also be kept in book form showing lengths, sizes, inclination, invert levels, surface levels, construction, manholes, &c., so that at



	1909-10	1910-11	1911-12	1912-13	1913-14
A	120 5/8	120 3/4	121 1/4	121 3/4	121 3/4
B	41	41 1/8	41 1/4	41	41 1/8
C	60 3/8	61 1/4	61 1/8	61 1/8	61 1/6
D	18 1/4	18 3/4	18 3/4	18 3/4	18 3/4
E	208	225	229	211	204
F	123	135	183	113	102
G	147	142	150	145	130
H	26	32	32	21	32
J	98	101	102	96	95
K	47	47	48	50	45
L	27	30	40	31	31
M	8	7	6	7	3
N	135	113	159	177	137
O	20	20·25	25·54	21·52	19·18
P	34,254	33,644	31,957	30,415	29654
R	23,400	22,000	19000	19500	18100
S	7,300	9,200	10000	13500	13000
T	3,634	3,444	1937	3413	854
U	39,000	39,000	39,000	39,000	46000

Explanation.

A—Total mileage of roads. B—Mileage macadam roads (granite). C—Mileage macadam roads (flints). D—Mileage macadam roads (paved). E—Total cost per mile (marginal No.×10). F—Cost of collection and disposal in pounds per mile (marginal No. × 10). G—Cost of collection (sweepers, shootmen, horse and stable, proportion of depot clerks, &c., wages), (marginal No.×10). H—Cost of disposal only in pounds per mile (marginal No. × 10). J—Cost of sweeping only in pounds per mile (shootmen, sweepers, &c., no horse and stable), (marginal No.×10). K—Cost of horse and stable in pounds per mile (collection), (marginal No.×10). L—Cost of watering in pounds per mile (team labour, water, &c.), (marginal No.×10). M—Cost of other charges in pounds per mile (marginal No.× 10). N—Total days rainfall registered (marginal No.×10). O—Total rainfall in inches (marginal No. × 10). P—Total loads collected and disposed of (marginal No. × 1,000). R—Loads to barge (marginal No. × 1,000). S—Loads to chargeable shoots (marginal No. × 1,000). T—Loads to free shoots (marginal No. × 1,000). U—Barge rates of disposal (in pence per 1,000 tons), (marginal No. × 1,000).

Fig. 8.—Highways Cleansing, Scavenging, Watering (Mileage, Costs, &c.).

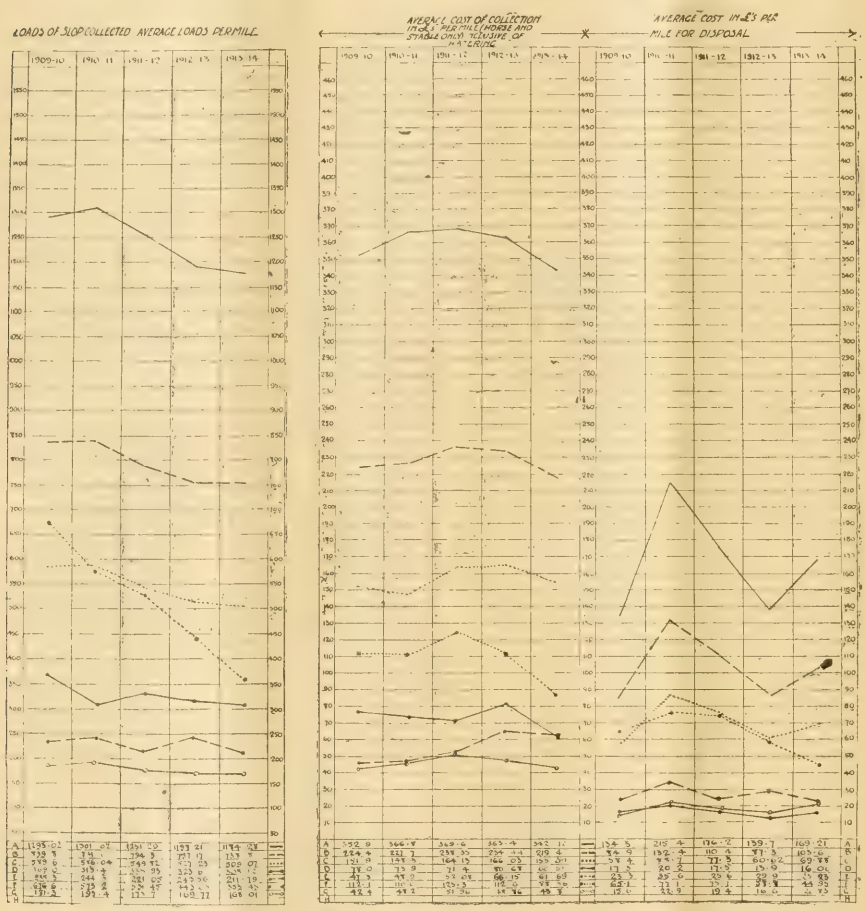
short notice particulars as to any part of the system could easily be ascertained.

For convenience in designing extensions of a system, whether by the local authority or private landowners, a line diagram showing the various sewers, sizes, and discharging capacities when flowing full is of great value, and if kept up to date will indicate at a glance when a sewer is receiving its full quota.

For maintenance purposes a careful municipal engineer will have prepared definite instructions for the order of "flushing," with positions where the flushing operations are to take place to give efficiency with economy, and will have daily reports from the sewer length of sewer, and from the information thus gained an annual diagram could conveniently be devised to illustrate the variations year by year, with explanatory notes as to any excessive expenditure.

HIGHWAYS (MAINTENANCE, CLEANSING, SCAVENGING AND WATERING).

At the present time probably the want of convenient forms in which records should be kept is felt more in highways than in any other department of the municipal engineer; in fact, the Roads and Tramways Committee of the institution ask members to send to the secretary copies of the forms in which they keep their statistics of road upkeep, maintenance,


LOADS OF SLOP COLLECTED AVERAGE LOADS PER MILE
AVERAGE COST OF COLLECTION IN £'S PER MILE (HORSE AND STABLE ONLY INCLUSIVE OF H.A. ERIDGE
AVERAGE COST IN £'S PER M.L.E FOR DISPOSAL
1909-10
1910-11
1911-12
1912-13
1913-14

Explanation.

A—Main wood-paved roads. B—All wood-paved roads. C—Rye wood-paved roads. D—Asphalt-paved roads. E—Sett-paved roads. F—Macadam roads (bus and other heavy traffic). G—Macadam roads (other than above). H—(——).

Fig. 9.—Cleansing and Scavenging—Various Classes of Roads.

flushers as to which sewers have been flushed, and if any are omitted as to reason of omission, and any defects which may have been noted. Correct daily returns would also be made as to the number of loads or the amount of water used at each flushing station, together with the source of each load or quantity of water used.

When a flushing van is in use it is possible to arrange for very accurate diagrammatic charts to be kept of the quantity of water used from any source. From these records the municipal engineer will be able to set up a diagram to show the cost of flushing operations and how the cost is allocated—against manual labour, team labour or mechanical haulage, water and repairs to plant, week by week—together with the proportionate times actually spent daily by the flushers in travelling and in flushing operations.

Again, as to repairs and maintenance of sewers, all details of expenditure would be kept against each cleansing, watering, tarring, &c., so as to assist them in preparing suggestions for securing uniformity in practice. The type of diagram or diagrams depends upon the information to be contained in the suggested records; but the author cannot forbear reproducing some interesting charts on the lines and from information kindly supplied to him by Mr. W. Oxtoby, M.Inst.C.E., the borough engineer of Camberwell, as specially applicable to highways (Charts 7, 8 and 9).

DISPOSAL OF REFUSE.

No reference has been made in the preceding pages to the use of destructors for the disposal of refuse, and this is intentional, because the many details required to be dealt with would enlarge this paper beyond the time which can be allowed for its consideration.

The analysis of destructor results entails a considerable amount of labour; records have to be kept

of the amount of refuse delivered day by day, the cost of the labour involved in the destruction of the refuse, labour and materials required in the repair and maintenance of the plant, the cost of the various items, the generation and utilisation of the waste heat, the cost of the disposal of the clinker, &c.

Although many valuable results have been published from time to time in the "Proceedings" of the institution, the members will probably agree that they do not convey by any means any very great idea of the comparative value of a particular type. To do this it is necessary for complete and accurate daily records to be kept over a long period; such results must be tabulated on a systematic basis, and consideration must be given to the varying qualities of refuse destroyed in the various types. This is, however, not the time to go into the question of a "comparative" basis—space will only permit of a general *resumé*.

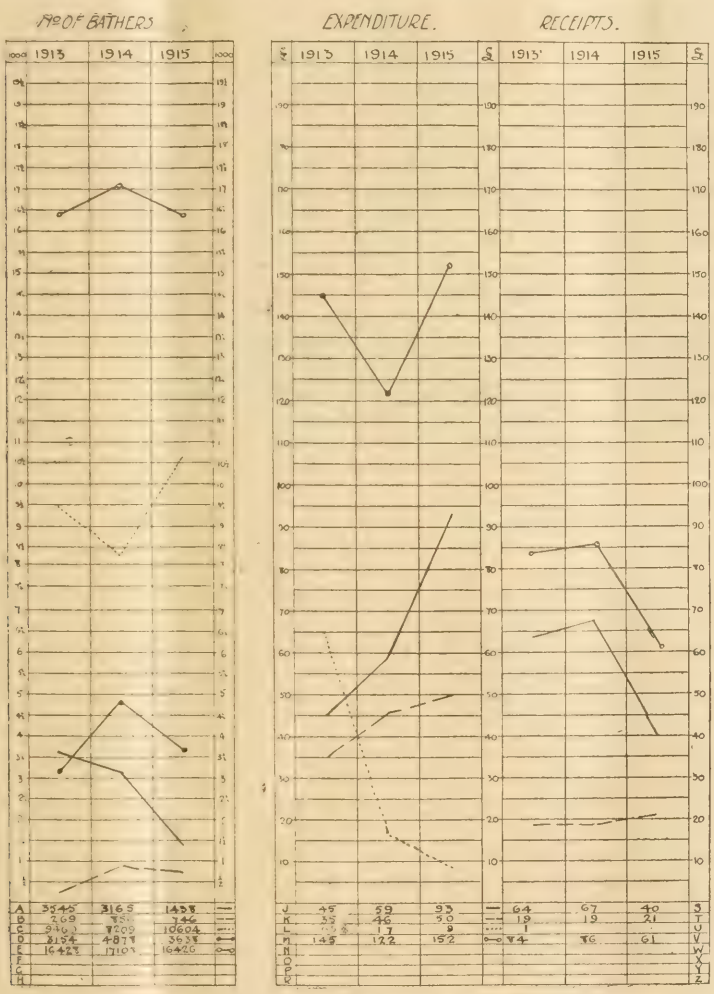
A careful municipal engineer will have records kept of the weight of refuse delivered daily to the destructor; he will also know how many times each cell has been charged and clinkered, and the weight of clinker, ashes and fine dust removed, and how it is disposed of; he will, further, have the labour charges allocated against the various items. Records will be kept of the making and utilisation of the steam (if any) generated from the heat, which would otherwise be wasted, and many other items of interest and value. All these records can conveniently be represented by diagrams.

BATHS AND WASH-HOUSES.

Although baths and wash-houses are not as a rule erected to pay their way, it is always useful to know exactly to what extent the baths, &c., are used, day by day as well as year by year, and also the expenditure on the various departments. Thus, in some districts there are separate establishments of public wash-houses, covered baths (swimming and slipper), or open baths, each of which require different treatment; it is not possible to go into full details.

The author, however, submits the particulars relating to the open baths erected and worked under his supervision. Chart 10 shows the workings for three seasons, the details being obtained from daily and weekly records. The use of the baths day by day during 1915 is illustrated by the diagram exhibited.

Many other forms of diagrams can be utilised by a municipal engineer to assist him in carrying out his multifarious duties. Key plans of a district are very useful in arranging for the collection of refuse, flushing sewers, removal of snow, position of street-name plates, vent pipes, fire hydrants, lamps, &c., a few illustrations of which are exhibited.



EXPLANATION.

A—Bathers, men. B—Bathers, women. C—Bathers, boys. D—Bathers, girls. E—Bathers, totals. J—Expenditure, labour. K—Expenditure, water. L—Expenditure, miscellaneous. M—Expenditure, totals. S—Receipts, bathing fees, except school children. T—Receipts, bathing fees, schoolchildren. U—Receipts, miscellaneous. V—Receipts, totals.

FIG. 10.—BATH RETURNS.

FERRO-CONCRETE BRIDGE CONSTRUCTION IN ESSEX.

NEW STRUCTURE OVER RIVER COLNE.

One of the first ferro-concrete bridges built on the Mouchel-Hennebique system for the Essex County Council crosses the river Colne at Colne Ford, Earl's Colne, a pleasantly situated village several miles above the important town of Colchester.

The view reproduced herewith is from a photograph of the finished structure, and gives a good idea of the bridge and the pleasing manner in which it harmonises with a particularly attractive piece of river scenery.

The bridge formerly existing on the same site was a timber structure, and although this was originally sufficient for the traffic requirements prevailing at the time of its construction, the design was not of convenient character, as the bridge formed a very awkward angle with the main highway. Moreover, it was of insufficient strength for modern vehicles, and owing to progressive decay it had become unsafe for use, in spite of all that could be done in the way of repairs and strengthening work.

View of Earl's Colne Bridge.

Consequently the Essex County Council, on the advice of their surveyor, Mr. Percy J. Sheldon, M.Inst.C.E., decided upon the construction of an entirely new bridge in Mouchel-Hennebique ferro-concrete, the initial cost of which is about the same as that of good timber work, and the ultimate cost very much less, owing to the permanent endurance of the material and the immunity it provides from annual maintenance charges.

The old bridge was less than 20 ft. wide, and necessitated a corresponding reduction in the width of the highway, the alignment of which has been much improved since the completion of the ferro-concrete bridge with a width of 30 ft. In addition to the straightening of the main road, the new bridge makes provision for the passage of the heaviest mechani-

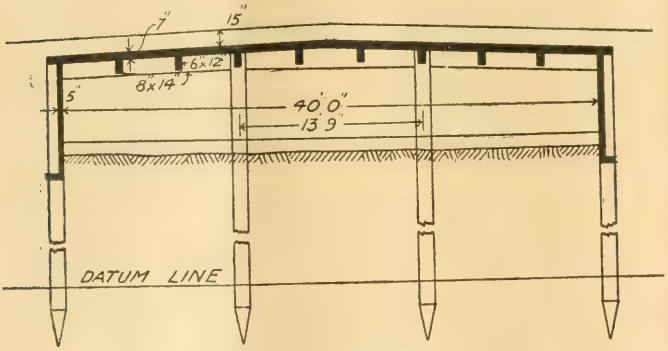


Fig. 1.—Longitudinal Section.

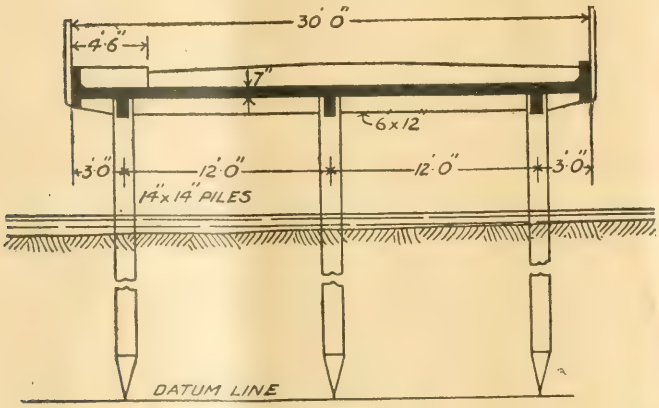


Fig. 2.—Cross Section.

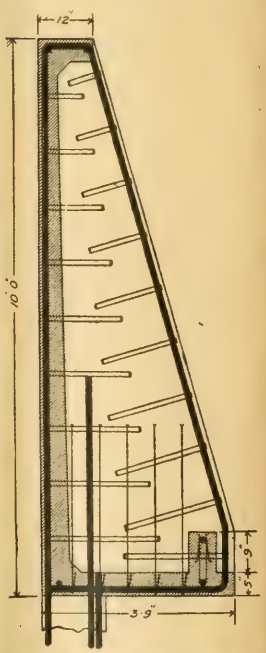


Fig. 3.—Section of a Typical Counterfort.

Earl's Colne Bridge.

The Surveyor
And Municipal and County Engineer.

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cally propelled vehicles at present in use or that are likely to be introduced at any future time.

A trial borehole made for the purpose of ascertaining the nature of the subsoil was carried to a depth of 13 ft. below the surface, with the result that the subsoil was found to consist of loam to a depth of 6 ft.; after this came a 2-ft. layer of clay and mud, and then a deposit of mud to which no bottom was encountered. It was evident, therefore, that special care would have to be bestowed on the foundations of the bridge, but this involved no difficulty in connection with ferro-concrete, which is specially adapted to foundation work in unstable soil.

The bridge proper is 40 ft. long between abutments by 30 ft. wide from parapet to parapet.

Figs. 1 and 2 are respectively longitudinal and cross-sections of the bridge proper. Each abutment is founded on three 14-in. square ferro-concrete piles, which are continued upward as columns, measuring 14 in. by 9 in. in cross-section to the top of the abutment, the columns being monolithic with a continuous curtain wall, 5 in. thick, connected with the wing walls described later. The columns are spaced 12 ft. apart from centre to centre, and between them the wall is stiffened by two rectangular counterforts, each with a cross-section of 9 in. by 6 in. Thus the wall has a series of stiffeners at regular intervals of 6 ft. apart. It is carried at the base by a ferro-concrete footing beam, 16 in. wide by 8 in. deep, supported by the foundation piles, and connected with the wing walls at each end.

The top of each abutment is finished by a coping which is virtually an extension of the bridge decking. The whole of the work described above is reinforced in accordance with standard Mouchel-Hennebique practice, which provides in a scientific manner for resistance to all possible stresses in the structure.

As represented in the longitudinal section, the bridge comprises three spans, 13 ft. 9 in. from centre to centre of the piles, the longitudinal beams being continuous and measuring 8 in. wide by 14 in. deep. They are connected laterally by a series of transverse beams, 6 in. wide by 12 in. deep, spaced 3 ft. 3 in. apart centre to centre, and the decking slab, 7 in. thick, forms a continuous compression flange for the entire series of beams.

Fig. 2 further illustrates the arrangement, showing the cantilever extension of the transverse beams terminated by an outer longitudinal beam at each side of the bridge, the upper part of these members acting as a kerb for the roadway at one side and for the footpath at the other side. The roadway is 25 ft. 6 in. wide and the footpath 4 ft. 6 in. wide.

Fig. 3 is a section of the counterfort at the junction of the lower right-hand abutment and the corresponding wing wall, but may be regarded as typical of all the other counterforts, which differ only in dimensions.

This counterfort is founded upon a 14-in. square ferro-concrete pile, and has a base 3 ft. 9 in. wide monolithic with a 5-in. foundation slab of the same width, and extending for the whole length of the wing wall. The slab is stiffened between the counterforts by a beam or rib, 6 in. wide by 9 in. deep. The counterfort is strongly reinforced by bars projecting from the pile and by other bars and stirrups, as shown in the drawing. The counterfort in question is 10 ft. high, the wing wall being 6 in. thick at the bottom, tapering to 4 in. at the top, where a coping 12 in. wide completes the structure.

The wing walls range from 18 ft. to 28 ft. in length and provide in an effective manner for the support of the new embankments constructed as a part of the road improvement scheme.

On completion of the work the bridge was officially tested under the moving load of two 12-ton steam rollers, which were run across the roadway at various speeds without appreciable deflection, thus demonstrating clearly the strength and rigidity of the construction.

The bridge was designed by Mr. Percy J. Sheldon, the Essex county surveyor, and constructed by the Yorkshire Hennebique Contracting Company, Limited, in accordance with working details prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

Wanted: A Steam Roller. — Yiewsley Urban District Council have for some time past been endeavouring to purchase a steam roller, but have been unable to obtain one.

Hospital Contractors' Loss.—At the last meeting of Easington, Durham, Rural District Council, the Hospital Committee reported on the subject of the application of Messrs. Christopher Brown, Limited, contractors, West Hartlepool, who built the new infectious diseases hospital, to the effect that a month ago the firm applied for a war bonus of £1,007, owing to their having lost £1,450 on the contract. The committee recommended that the council allow 10 per cent extra on all work which was not completed at the outbreak of the war, and this, it was stated, would amount to £530. The council adopted the recommendation.

Road Improvement Fund.—During the year ended March 31st last £694,395 was received by the Road Improvement Fund from the Consolidated Fund in respect of motor spirit duties and carriage licences. Of this sum £169,354 was balance due in respect of 1914-15, and £525,041 was on account of duties, &c., collected in 1915-16. It is explained in the report of the Comptroller and Auditor-General that under the provisions of sec. 49 of the Finance (No. 2) Act, 1915, any further charges on the Consolidated Fund in respect of the Road Improvement Grant were suspended until Parliament otherwise decides, and the amount of £525,041 represents issues made before the passing of that Act.

Manchester Corporation's Tube Contract.—In the House of Commons last week, Sir J. Lonsdale asked the President of the Board of Trade if he was aware that the Manchester Corporation had been compelled to accept a tender for boiler tubes from a German-owned firm, owing to the fact that these tubes, which were essential to their electricity and gas undertakings, could not be obtained from any other source; if the English works of this German company were a controlled establishment under the Munitions of War Act; and if steps would be taken to extinguish the German interests in this business and place it entirely under British control. The First Commissioner of Works (Mr. Harcourt) said that if the name of the firm referred to was supplied to him he would have the matter looked into at once.

Timber, Plywood and Woodwork.—We would direct the attention of our readers to the full-page advertisement of Messrs. C. Jennings & Company, of Pennywell-road, Bristol, which appeared in our issue of last week. The information given in the advertisement should be of the greatest value to all users of timber, plywood or woodwork. We understand that the firm are prepared to answer any questions relating to the materials of which particulars were supplied, or furnish prices delivered to any part of the world, either of goods mentioned in the announcement or of others not included in it. They inform us that they hold stock at their branches and warehouses at Porthcawl (South Wales), Leyland and Pembroke Dock, Leicester, Swansea, Hull, Liverpool, Manchester, Newcastle and other places, and will be pleased to receive inquiries.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

SURVEYORS' PETROL ALLOWANCES.

To the Editor of The Surveyor.

Sir,—Previous to the outbreak of war I was in charge of an urban district sufficiently compact to be administered without a motor cycle. Some months back I undertook the duties of a rural colleague who has enlisted. I found it imperative to purchase a motor cycle to enable me to travel quickly and keep the work of both districts well in hand.

I applied for licence to purchase 5 gallons of petrol per month, but am limited to two; in consequence my work is restricted.

As with your correspondent, "A County Road Surveyor," the muddle will pay me, as I receive no allowance whatever towards travelling expenses.

I have tried to eke out my supply by diluting with paraffin, but my first attempt was not a success. I am told, and I believe it correct, that I ought to have used the inferior brand of paraffin instead of the best. —Yours, &c.,

Urban Surveyor.

August 11, 1916.

STEAM TRACTORS v. HORSE HAULAGE.

To the Editor of The Surveyor.

Sir,—The above is a subject of great interest. No matter for what purpose the haulage may be, it is getting a difficult business to hire or purchase horses, and mechanical traction will, no doubt, very considerably increase in the future, although it is a generally accepted fact that the mechanical does not favourably compare with the horse for short or interrupted journeys, such as delivery of coal to householders in small quantities, refuse collection, &c.

Looking through the figures given by Mr. H. Hopkinson, cleansing superintendent to the Portsmouth Corporation, I was very much surprised at the figures therein given as to the cost of working a Foden wagon and trailer: Fuel, 4s. 7½d.; wages, 8s. 4d.; total, 12s. 11½d. per day. Evidently the driver and mate collect the refuse, averaging 45 cub. yds. per day, carry it to the wagon, which evidently must be mounted by ladder—and all for 12s. 11½d. I could not get a driver and mate at the wage, and I am certain a driver of a Foden would not combine the occupation of scavenger, whatever the wage might be. My experience of the cost of a 5-h.p. steam tractor at the present time, allowing 15 per cent depreciation, is 28s. 6d. per day, the driver and mate being paid extra for loading trucks in quarry or railway station for shovel work.—Yours, &c.,

Tractor.

August 14, 1916.

SETT PAVING: FOUNDATIONS.

To the Editor of The Surveyor.

Sir,—It has been interesting for me to read the paper on "Improvement of Highways" that the county surveyor of Lancaster read at the annual meeting of the Institution of Municipal and County Engineers, and to notice that it was generally accepted that the success of sett paving depended on rigid foundations.

Will you allow me to say that I was of the same opinion until recently, but when one has seen how well the sand-bedded *pavé* roads in Flanders, laid on clay, have withstood the enormous traffic, one's views are much modified as to the necessity of providing elaborate and expensive foundations.

It may also interest my *confrères* to know that split setts are very rare, in spite of steel-tyred vehicles with heavy loads.—Yours, &c.,

A Municipal Engineer at the Front.

August 10, 1916.

Non-slip Road Surfaces.—A street with a rough surface to prevent skidding in wet weather has been laid in San Francisco. The base is prepared in the same manner as that employed in laying an asphalt street. Hot asphalt mixture of the desired thickness is spread and a quantity of 1-in. broken stone is rolled into the surface. The slight unevenness caused by the projecting points makes skidding unlikely, and furnishes a good footing for horses. Some of the pavement laid three years ago has been so satisfactory that more is being built every year.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Does not the controversy upon the collection of house refuse by petrol-motor wagons resolve itself into this: Given a long non-stop run it pays, if not it doesn't? Is not this reversed in the case of electrically driven motor vans—viz., frequent stops, and it pays; long runs, especially uphill, and it doesn't? Could not both systems be combined by means of small central depots, and movable bodies raised and dropped into place by an electrically driven crane?

* * * *

Is it a fact that, where concrete is required to set quickly after being placed in situ, it is a good plan to leave it on the banker for about a couple of hours after it has been mixed? Has this been tried anywhere, and, if so, with what results?

* * * *

Will the recent diversion of all the traffic in Park-lane, during repairs, into the Hyde Park road stir up the advisers to H.M. Office of Works to a study of the road question, and be the means of a better and more modern method of construction than has obtained in the past? Is it not to be hoped that the motto "It is an ill wind that blows nobody any good" will be effective in this case?

* * * *

Should not every surveyor, and, indeed, every councillor, read Mr. H. G. Wells' book "What is Coming," from page 77 to page 82 inclusive, if he desires to study a layman's views on the municipal muddle that pervades this country? Should not the inhabitants of the villages of Bocking and Braintree in Essex feel very proud that these two places should have been selected by Mr. Wells for his sarcastic remarks?

* * * *

Were there not in a recent number of *Engineering* some very practical suggestions on the education of engineers, in which it was pointed out that those engaged in the engineering industry might be divided into two classes—the "workers" and the "thinkers"? Was it right, however, to suggest that the same training is not the best for both, although it was allowed that many of our ablest engineers have risen from the ranks? Is not a practical training almost essential for an engineer, whether civil or mechanical, up to a certain point or age, followed by a sound technical university training for those who are to develop into the "thinkers"?

* * * *

Is it not rather interesting to note that a somewhat complicated situation has arisen in connection with the Daylight Saving Bill at Oldham, where the consumers of electric current are charged a flat rate of 4½d. per unit up to 10 p.m., and 2d. per unit after that hour, and that the town council, who supply the current at these rates, did not alter the meter clocks to meet this contingency, so that consumers are charged for an hour more at the extra rate than they would have been if the clocks had been altered? What are the consumers going to do under these circumstances? Will they grin and pay, or refuse to do so and let the council proceed against them for payment?

* * * *

Why has it been left to the *Engineering News* of New York to call attention to the need of a proper definition of a large number of engineering terms, and to suggest the formation of a technical committee which should undertake the production of a reliable engineering dictionary? Is not such a dictionary greatly wanted in this country also?

* * * *

Is it at all a matter of surprise that a dictionary should be sometimes wanted to explain the meaning of some of the complicated words used by medical officers of health in their reports, in order that members of the council should understand them, and reporters spell them properly? Was it not rather amusing, however, to read the other day in the local Press that at a meeting of the Norham and Islandshires, Northumberland, Rural District Council there was something of a dispute as to whether a dictionary had been ordered or not for this purpose, and that the medical officer of health finished the discussion by saying: "Very well, if there is no dictionary I shall proceed with the report"? What was the inner meaning of this dire threat?

Law Notes.

EDITED BY J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

ISOLATION HOSPITAL POWERS OF COUNTY COUNCIL. — The decision of the Court of Appeal in *Attorney-General* v. *Derbyshire County Council* has been affirmed by the House of Lords. The question at issue was the extent of the powers of the council with respect to the constitution of the committee of an Isolation Hospital under the Isolation Hospitals Act, 1893, and 1901. The council in 1907 made an order creating a united district for the purpose of establishing the hospital, and determining the representation on the committee of the council and the local authorities. In 1914 differences arose between the council and the Barlow and Bulmell Urban District Council one of the local authorities in question on questions of policy, in consequence of which the county council made a further order varying the constitution of the committee by increasing the number of their own representatives to nine and reducing that of the urban district council to half a member, thus giving themselves such an absolute majority on the committee that they could entirely control its policy. It was held that this order was not *ultra vires*, inasmuch as the county council had power at any time, provided they directly contributed to the funds to be administered (which they did), to dissolve the committee and create a new one, and to vary the representation thereon by reducing that of the local authorities and increasing their own.

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter* X, *combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

MATERIALS FOR SURFACE REPAIR. QUARRYING AND LORDSHIP.—"C. B. M. B." writes: (1) Will you kindly give me your definition of the words "inclosed land" in the following clause of sec. 80, Schedule C, Roads and Bridges (Scotland) Act, 1878: "And carry away any such materials in or out of the inclosed land of any person where the same may be found," a question having arisen as to quarrying on the side of a certain road across which there are several gates which form part of the division fences between farms, or between farms and woods, the fences and gates being upkept by the proprietor or tenants. The road runs north and south, the division fences running at right angles to the road from a wall or fence on the east to the sea on the west. At certain points the road is fenced next the sea, but in the case under review the road runs through a wood with a gate at each end, there is no fence along the shore, nor is the road fenced off from the wood, though the wood as a whole is fenced on three sides. The owner of the wood contends that the wood is "inclosed land" within the meaning of the Act, while, on the contrary, it is stated that, as the wood is open to the public road there being no fences along the roads the land is therefore not "inclosed." (2) There is also a question as to "stone to be used for building" in the same section of the Act. One party maintains that lordship can only be charged for stone actually used for building walls, bridges, houses, &c., and not on stone, however suitable for building purposes, which is broken into metal and used for surface repair; the other that all "building stone"—*i.e.*, suitable for masonry, whether used for building or broken up into metal—can be charged for.

(1) I am not aware of any authority on this point, but in my opinion the wood is not "inclosed land" within the meaning of the Act. In England the meaning of the expression "inclosed land," as used in the Highway Act, 1835, sec. 73 (which requires notice to be given to the owner of "inclosed land" before materials are taken), was to some extent elucidated in the Exhausted Parish Lands Act, 1841. That Act provides that land in the exclusive occupation of one or more person or persons for *agricultural* purposes is to be deemed to be "inclosed land" within the meaning of the Act of 1835, although the same may not be separated from any adjoining lands of other persons, or from the highway, by any fence or other inclosure. These Acts do not apply to Scotland, however, and, in the absence of any authority to the contrary, I think "inclosed land" in the Act of 1878 may be taken to mean land inclosed on all sides. (2) I do not think that stone actually broken up into metal and used for surface repair can reasonably be held to come within the description of "stone to be used for building," even though it may be suitable for building purposes.

WORKS: BUILDING BY-LAWS.—"H. C." writes: In this district there are iron and steel works, chemical works, &c., and from time to time extensions, alterations and additions are made—for instance, at the iron and steel works extensions of the furnaces, new sets of boilers and plant, alterations of workshops, and the roofing in, &c., of machinery and plant. Some of the work is of a permanent character, other including roofs carried on stanchions and wooden lean-to sheds against existing buildings, &c., and occasionally a building is moved to another part of the works to allow for extensions of machinery, &c. At the chemical works new stills and large boilers and tanks are erected on concrete piers for storage and in connection with the process of distillation. I cannot find that any plans have been submitted. Is it necessary for plans of these extensions, alterations, &c., to be submitted to the council? The by-laws can hardly be applied to works of this nature.

I do not think it is necessary to submit plans of boilers or tanks; see *Grey* v. *Black Lion Brewery Company* (55 J.P., 711); but plans should be submitted of any alterations or additions which are of such a nature that they constitute the erection of a "new building." If sec. 23 of the Public Health Acts Amendment Act, 1907, is in force in the district the following would constitute the erection of a "new building" viz., raising any part of the roof, altering a wall, or making any projection. In order to be a "building" within the meaning of the by-laws a structure must contain some feature contemplated by, and dealt with in, the by-laws. See *Slaughter* v. *Sunderland Corporation* (60 L.J.M.C., 91).

CINEMA: BUILDING BY-LAWS.—"C. H." writes: Plans have been submitted for a proposed cinema. Very little information is given of the construction of the iron roof principals and gallery—in fact, it is only after discussing the plans with the architect that one knows how it is proposed to construct the gallery, as the plans might mean anything. I asked for detailed information to be shown on the plans, such as thickness of connection plates, mode of jointing and fixing the roof principals, and similar information regarding the gallery, when I was informed that it was not necessary to supply it, and I could not demand it. Our by-laws do not deal with iron roofs or galleries. I shall be glad to have your opinion and advice.

Under by-law 104, "complete" plans and sections of "every floor" of an intended building are to be delivered, which are to show "the position, form, and dimensions of the several parts of such building." From what is stated as to the plans submitted in this case it would appear that they are very far from "complete." I think the details asked for ought to be given. I would point out that, under by-law 67, rule (10), in the case of a roof covered with (*inter alia*) iron, the timbers of the roof must be of such size and strength as may be adequate to secure due stability.

REFUSE TIP: COMPULSORY PURCHASE. "Bishwith" writes: The rural district council have endeavoured to lease land for a refuse tip, but the owner refuses to lease or sell the land. Can the council take the land by compulsory purchase for the purpose of a refuse tip?

Inasmuch as the council are authorised by sec. 113 of the Public Health Act, 1875, to provide receptacles for the temporary deposit of refuse, it would appear that they can acquire land compulsorily for this purpose under secs. 175 and 176 of that Act. A Provisional Order of the Local Government Board would have to be obtained before the compulsory powers could be exercised.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

AN AMERICAN ELECTROLYTIC SEWAGE DISPOSAL PLANT.

"TOO EXPENSIVE AND UNCERTAIN."

A final report to the Board of Estimate and Apportionment, City of New York, on the Landreth electrolytic sewage disposal plant at Elmhurst, Long Island, has just been made by the City Board of Consulting Engineers (made up of the chief engineers of the Board of Estimate and Apportionment and the consulting engineers of the several boroughs of the city). The board considers the continued use of this plant as too expensive and uncertain, and recommends the temporary use of chemical precipitation and sludge-drying beds at this point pending a permanent connection to projected sewers.

HISTORY OF THE ELMHURST PLANT.

In 1900 (says *Engineering News*) a disposal plant was authorised by the Board of Public Improvements for Elmhurst. It consisted of four settling tanks and three sand filters. On account of the continuance of objectionable odours, in 1914 a small (25,000-gallon) experimental Landreth plant (employing simultaneous lime precipitation and electrolysis) was installed (by the Electro-Chemico Corporation, of Philadelphia). Reports on this machine were made (1) by Messrs. P. M. Travis, chemist, and E. I. Firth, engineer, for the borough of Queens; (2) by Messrs. R. H. Brown and W. T. Carpenter, for the Bureau of Sewer Plan; (3) by Messrs. F. A. Cleveland, for the Bureau of Municipal Research; and (4) by Messrs. E. J. Fort and C. E. Gregory, for the Bureau of Sewer Plan.

A large unit, capable of handling 750,000 gallons per day, was installed in 1915, and two studies have been made on that—(5) one by Messrs. W. P. Mason, J. C. Olsen, C. O. Mailloux, and P. M. Travis, for the Electro-Chemico Corporation; and the other (6) by the Bureau of Sewer Plan, for the Board of Estimate and Apportionment.

There was not entire accord in the results of these investigations. For instance the first (Travis and Firth) report showed a requirement of 144 kw.-hour per 1,000,000 gallons, and 1,257 lb. lime. This electrolytic machine (vertical type) was 24 by 18 in. in section and 7 ft. 3 in. high. The current was split between carbon and steel electrodes, and paddles were revolved between these plates. No great technical skill was required for operation, and no apparent wear was found on the iron electrodes. Immediate coagulation, wonderfully quick settlement and bactericidal action (99·819 per cent) beyond possible action of lime alone was reported. The dissolved oxygen was "considerably increased," and the oxygen consumed by organic matter "enormously reduced."

The later reports (3) were less optimistic. For instance, in the Brown-Carpenter-Cleveland series, time of passage through the machine was given as 2¼ minutes, and the time of filling the sedimentation tank 1½ hours. The previous high bacterial reductions were not repeated (only from 30 to 94 per cent in effluent from the machine, and from 97 to 100 per cent in the settlement tank effluent). The machine was found very sensitive to change in character of sewage. The reduction in total suspended solids was between 65 and 83 per cent. The reduction in suspended organic matter was 3 to 7 per cent in the machine effluent and 38 per cent in the tank effluent. The reduction in consumed oxygen ran from 2 to 95 per cent for machine effluent and 23 to 80 per cent for tank effluent. The increase in dissolved oxygen for these two effluents was 18 to 87 per cent and 53 to 68·5 per cent respectively.

On running the machine with lime only (without current) the chemical results and bacterial reduction in machine effluent were equal to that of regular operation—except in the appearance of the flock and the higher dissolved oxygen content after sedimentation. Without the paddles the flock was formed slower and the bacterial reduction less. No bacterial reduction in machine effluent was obtained in operating with lime added at 375 lb. and 684 lb. per 1,000,000 gallons. On increasing the content to 1,040 lb., the reduction was 72·3 per cent. On 2,210 lb., the reduction was 94·1 per cent. About 17½ cub. yds. of sludge (94 per cent moisture) was formed per 1,000,000 gallons.

The large plant as tested by Messrs. Mason, Olsen & Mailloux employed in order: (1) screening; (2) addition of lime; (3) electrolysis; (4) sedimentation; (5) sludge pressing. The machine was a covered horizontal box, 3 by 2¾ ft. in section and 23¼ ft. long. The flow was between sets of parallel steel plates with paddles revolving parallel to the plates. The maximum values of current supply were 125 volts and 40 amp. The time of flow through the tank was 68 sec. The time in the sedimentation tanks was about 4 hours. With 1,000 to 1,300 lb. hydrated lime per 1,000,000 gallons, the raw sewage and machine and tank effluents showed, for instance, oxygen saturations of 25·5 per cent, 31·8 per cent, and 45·5 per cent, and bacterial counts of 1,100,000, 846,000 and 800.

When lime was used in the machine (1,510 lb. per 1,000,000 gallons) but no current, the machine effluent became darker with smaller flocks. The bacterial reduction in raw sewage and machine and tank effluent was from 210,000 to 11,150 and 61,000 (for the last, bacteria rose to 9,360,000 after standing two days). The percentage of saturation for dissolved oxygen rose from 28·4 per cent to 43·9 and 44·3 per cent; the consumed oxygen in the final effluent was 25·7 per cent.

COSTS.

In regard to costs, for a 1,000,000-gallon plant, Messrs. Mason, Olsen & Mailloux reported: 1,300 lb. lime, $5·14; current, 85 k.w. hours for electrolysis, 60 k.w. hours for agitation, 174 k.w. hours for pumping, and 16 k.w. hours for lime vat, at 4 cents, $13·40; sludge pressing and removal, $5·11; labour and supervision, $12·50; maintenance and supplies, $1; total, $37·15.

On account of the lack of accord of the reports they were all submitted to Mr. Earl B. Phelps, of the United States Public Health Service Hygienic Laboratory, for review and report. His findings were: (1) that the final effluent was highly satisfactory; (2) that the method of sludge disposal was not satisfactory and could not be employed where there was real necessity for sewerage purification; (3) that there was good basis for honest difference of opinion as to whether the electrolysis contributed materially to the results; (4) that the cost was too great to compete under usual conditions with better known processes.

In considering what to recommend at Elmhurst the City Board of Consulting Engineers considered the annual cost per 1,000,000 gallons of the following: Electro-chemical ($48·19) and activated sludge ($39·38) processes, sprinkling filters ($36·45), chemical precipitation ($30·63), pumping to Fifty-first-street sewer ($24·05) and to Booth-street sewer ($22·15). The electro-chemical process was dismissed because of cost and the uncertainty of results with stronger sewage.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Barrow T.C.—£10,300 for electrical extensions.

Dewsbury T.C.—£25,000 in connection with the gas-works.

LOAN SANCTIONED.

Berks C.C.—£3,090 for the improvement of the Bath road.

FORTHCOMING INQUIRIES.

AUGUST.	£
22.—**Wantage.** For works of surface-water drainage (Mr. A. G. Drury)	600
22.—**Wantage.** For works of sewage disposal (Mr. A. G. Drury)	2,550
23.—**Aldershot.** For the provision of public conveniences (Mr. A. G. Drury) ...	1,000
24.—**New Sarum.** For the provision of water-pumping plant (Mr. W. O. E. Meade-King)	4,200
SEPTEMBER.	
Town Planning.	£
13.—**Neath.** (Mr. George L. Pepler)	—

Rhymney Valley Sewerage Works.—At a meeting of the Rhymney Valley Sewerage Board on Wednesday the engineers, Messrs. Chatterton & Alford, reported that on July 27th the contractors, on their own initiative, ceased work on contract No. 1. The board decided to give notice to the resident engineer and inspector to terminate their contract.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Arbroath T.C.—The Local Government Board have approved of the proposed arrangement for the acquisition by the town council of the two-sevenths share of the Arbroath District Committee of the county council in the isolation hospital in which both bodies have had a joint interest since its erection. The price to be paid by the town council is £3 250. The Local Government Board approve of the proposal of the burgh local authority that the diphtheria pavilion at the hospital used at present for tuberculosis should be permanently reserved for the treatment of tuberculosis.

Falkirk T.C.—The town council have accepted with thanks a gift of £3,000 from Mr. Robert Dollar, of San Francisco, California, for the purpose of building public baths in Falkirk, of which he is a native.

Ipswich T.C.—The town council have accepted the offer of the Carnegie Trustees to give £15,000 for the provision of a central public library.

Middlesbrough T.C.—The borough surveyor, Mr. S. E. Burgess, has been asked to prepare plans for the extension of the sanatorium.

Stockport T.C.—It is proposed to purchase property at a cost of £2,700 for the purpose of an electricity generating station.

MOTOR TRANSPORT.

Barrow T.C.—Tenders are to be obtained for an electric lorry.

Ilford U.D.C.—The question of providing hauling lorries and road-watering machines is being considered.

REFUSE COLLECTION AND DISPOSAL.

Aldershot U.D.C.—In his report, the surveyor, Mr. F. C. Uren, stated that he would be glad to see an improvement in the type of dustbin, the receptacles at present employed in the town being in a very dilapidated condition.

Epping U.D.C.—The council are considering the question of dealing with the collection of house refuse by direct labour.

Petworth R.D.C.—In a report on an improved system for the collection of refuse, the inspector of nuisances *pro tem.*, Mr. G. T. Suter, advised the provision of proper domestic dust receptacles, but the council decided to defer the matter for the present.

Sandown U.D.C.—The General Purposes Committee reported that on the recommendation of the medical officer they had decided that householders should be urged to burn all the refuse possible. Considerable economy could be effected by this means, both from the point of view of the town and householders, and the committee were advised that the fly pest and its concomitant dangers would be mitigated, if not altogether avoided, were the suggestion carried out generally.

ROADS AND MATERIALS.

Argyllshire C.C.—The Lorn District Committee have approved of the line of route of the proposed road between Kinlochleven and Ballachulish. In connection with the scheme grants amounting to £4,000 will be received from the Road Board and the British Aluminium Company, in addition to the loan of £4,000 from the Road Board for seven years, free of interest, and a further loan of £11,500 upon the best terms which can be arranged.

Ayrshire C.C.—The estimates for the maintenance of highways for the current year were submitted at a meeting of the County Road Board on Tuesday. The estimated expenditure in the Ayr district was £12,936; in the Carrick district, £7,442; in the Kilmarnock district, £12,914; and in the northern district, £14,613, making a total of £47,907, or a decrease of £1,153 as compared with the previous year. There are 1,298 miles of highway in the county.

Baltinglass No. 1 R.D.C.—In consequence of no tenders, or unsatisfactory tenders, being received for work on a number of roads, the council referred the matter to the county council.

Baltinglass No. 2 R.D.C.—In consequence of the serious damage to certain district roads caused by the July storm, the council have adopted the recommendation of the county surveyor, Mr. S. G. Gallagher, to apply for an extension of the statutory limit of road expenditure from £1,633 to £2,400, in order to execute the repairs.

Bognor U.D.C.—The surveyor, Mr. O. A. Bridges, has received instructions to prepare a plan showing a widening of Chichester-road to an average of 22 ft. 6 in. in the vicinity of Longford-road.

Derry C.C.—The county surveyor, Mr. Charles L. Boddie, reported that damage to the roads and bridges, amounting to about £8,000, was caused by a cloudburst on July 24th. The districts affected included Derry No. 1 district, Coleraine, and Limavady. The county council are appealing to the Local Government Board as a matter of urgency to sanction a loan to meet the works of repair.

Kensington B.C.—Approval has been given by the Kensington Borough Council to a scheme of the acting borough engineer for laying clinker Mexphalte carpeting on clinker block paving which is in an unsatisfactory condition in certain streets. The area affected is 8,034 sq. yds., and the cost is estimated at 3s. 8d. per square yard. Highways Construction, Limited, are to lend the council a suitable crushing pan and provide expert advice and supervision at the council's works and on the streets. The works are to be carried out and the labour and materials supplied by the council. The Works Committee says it is not prepared at this stage to advise that clinker Mexphalte carpeting should be laid in streets used by heavy motor or other heavy vehicular traffic, though in Hornsey, where the material has been down for periods up to two years, certain roads treated with it are used to a certain extent by motor-'buses and other heavy vehicles.

Monmouthshire C.C.—The Main Roads Committee have been authorised to obtain a loan from the Road Board for five years free of interest, and to purchase engines, trailers, and stone crushers, at a cost not exceeding £2,000.

Steyning East R.D.C.—It has been decided to approve the proposal of the East Sussex County Council to insert in contracts for steam haulage similar conditions to those inserted in the contracts entered into by the county council. These conditions provide that the surveyor should have the right at any time to give such directions as he should think fit, both as to the number of trucks to be drawn and the weight of the material to be carried. In the absence of any special directions, the number of trucks to be drawn should not in any case exceed two, and the weight to be carried, exclusive of the weight of the engine and trucks, should not exceed 15 tons.

SEWERAGE AND SEWAGE DISPOSAL.

Chatham T.C.—The town council in committee have approved certain alterations in the plans of the proposed scheme for the internal sewerage of the borough, and have resolved to apply to the Local Government Board for a loan of £65,840 for carrying out the work, and £3,994, the fees payable to the engineer. It is not intended to proceed with the scheme until after the war.

Hertford R.D.C.—A site has been obtained at Tewin for the purpose of sewage disposal works.

Hendon U.D.C.—The council have spent recently about £20,000 in constructing additional precipitating tanks and percolating filters. The Local Government Board stopped the progress of the work owing to the present crisis. Mr. H. T. Wakelam, the county engineer of Middlesex, in his annual report, says he regards it as particularly unfortunate that this course has had to be taken, as the extensive works already carried out will be of no value until the whole undertaking is completed.

Kidderminster T.C.—A report has been prepared showing a profit of £624 from the sewage farm.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—It was reported that the total expenditure in connection with the promotion of the Water Bill was £5,116, and it was remarked that this

was the smallest sum the corporation had ever had to pay for the promotion of a Bill of such magnitude, involving the expenditure of about £500,000.

Arbroath T.C.—The working of the gas undertaking has proved so satisfactory that the price of gas has been reduced by 2½d. per 1,000 ft.

Blackburn T.C.—It is proposed to rebuild the Greenbank gasworks and instal vertical retorts, at an estimated cost of £85,000.

Chelmsford T.C.—It has been agreed to enter into a further four years' contract with the electric supply company for public lighting, conditionally upon the company withdrawing their opposition to the town council's application to extend for one year the option to purchase the undertaking.

Dawlish U.D.C.—An official visit was paid by members of the council recently to Thorns, the watershed of 300 acres purchased from Sir R. Newman, at a cost of £5,000. It was stated that the watershed would give a supply for a town two or three times the size of Dawlish, if there was storage for it. The surveyor, Mr. S. F. C. Churchward, said that unless the present waste was stopped in a few years it would entail an 8d. rate to meet the expense of bringing more water into the town.

Derby T.C.—An extension of the electric mains, at an estimated cost of £5,000, has been decided upon.

Dundee T.C.—The Electricity Committee on Monday resolved to make application to the Scottish Office for authority to increase the borrowing powers by £27,000 to meet important developments in the department.

Greenock T.C.—The accounts of the water undertaking for the past year showed a credit balance of £171, against an estimated debit balance of £1,675. The nett surplus on the electricity undertaking was £6,998.

Ilford U.D.C.—With a view to utilising the steam at the refuse destructor specifications are being prepared for a high-tension alternating plant at the electricity works. The cost is estimated at £7,000.

Merthyr T.C.—It has been agreed to support the scheme of the Rhymney and Aber water authorities for the construction of a proposed new main.

Rothesay T.C.—It has been agreed to raise the price of gas by 10d. per 1,000 cub. ft., making it 4s. 9½d. per 1,000 cub. ft., with the usual 10 per cent discount on accounts paid within one month of rendering. Slot meters are to be set to 16 cub. ft. for 1d., with discount of 10 per cent.

Stansted (Essex) R.D.C.—The surveyor, Mr. C. Hicks, has been instructed to report on the water supply at Manadin.

MISCELLANEOUS.

Stoke-on-Trent T.C.—The borough surveyor, Mr. A. Burton, reported that he had prepared a rough list of works which might be put in hand should the council so decide in case of distress works being necessary at the close of the war. The Highways Committee recommend the council to take the matter into their urgent consideration.

Teddington U.D.C.—The council on Monday decided not to agree to their workmen's application for an increase of wages, but to increase the weekly war bonus as follows: Carters, 3s. 8d. to 5s.; roller driver, 1s. 11d. to 4s.; scavengers, 2s. 5d. to 3s. 6d.; dustmen, 2s. 3d. to 4s.; road repairers, 2s. 10d. to 4s.; carpenter, &c., 2s. 11d. to 6s.

Conway-Colwyn Water Bill.—In the House of Commons on Monday, the Conway and Colwyn Bay Joint Water Supply Board Bill was read a third time and passed.

Sanitary Slackers in Dudley.—At Dudley Police Court on Wednesday three men were summoned by Thomas Lee, contractor, employed by the Sanitary Committee of the corporation, for neglect of work. Mr. W. H. Thompson, for the prosecution, stated that the men absented themselves on five days in the holiday week, but as they had expressed contrition he applied for the cases to be adjourned for two months. Mr. T. W. Smith (presiding magistrate) said the employer had taken a very lenient view of the case, especially in view of the danger to public health likely to result from the neglect of the work these men had to do. If the men did not attend to their duties in the future the magistrates would mark their displeasure in a very drastic way. The application was acceded to.

PERSONAL.

Mr. Philip Kent, surveyor to the Baldock (Herts) Urban District Council, has joined the Army.

Mr. W. H. Adams, chief assistant in the Romford surveyor's department, has joined the Forces.

Second-Lieut. Robert Rosbotham, surveyor to the West Lancashire Rural District Council, is in hospital at Rouen, suffering from gunshot wounds in the cheek.

Private H. Whitehead, a member of the junior staff of the City of London surveyor's department, has been awarded the Military Medal for bravery in the recent Somme fighting.

Mr. H. T. Ridge, surveyor to the Romford Urban District Council, who has been indisposed for some time past, in acknowledging a letter of sympathy from the council, states that he is not making much progress.

Mr. Raymond Unwin, chief town planning inspector to the Local Government Board, will, it is expected, shortly proceed to Dublin to advise the corporation in connection with the rebuilding of parts of that city.

Mr. M. Hainsworth, surveyor to the Teddington Urban District Council, has been authorised to act as consulting surveyor and sanitary inspector to the Hampton Wick Urban District Council while the surveyor to the Hampton Wick authority is on military service.

Second-Lieut. C. E. Maynard, R.A.S.I., 14th Northumberland Fusiliers (Pioneer Battalion), has recently been promoted full lieutenant. He has also been awarded the Military Cross for distinguished service in defending a small wood in the initial advance on the Somme on July 1st. In civil life Lieut. Maynard is assistant to Mr. W. J. Grant, surveyor to the Romford Rural District Council, who has been directed to forward the council's congratulations. Other assistants serving from the surveyor's department are Corporal F. Alderson, R.E., now in Salonika, and Gunner J. Page in Egypt.

Mr. Daft, who has been acting as deputy county surveyor of Oxfordshire, has joined the Forces, and the chairman of the county council, Mr. W. H. Ashhurst, stated at the quarterly meeting recently that the council were very fortunate in getting the services of a county surveyor with the experience of Mr. E. Purnell Hooley. He thought they were greatly indebted to that gentleman for taking the position, he having retired for some two or three years. Mr. Hooley was for a quarter of a century county surveyor of Nottinghamshire, and he is known among road engineers the world over as the inventor of "Tarmac."

OBITUARY.

Mr. J. Stanley Sawdon, Assoc.M.Inst.C.E., surveyor to the St. Annes-on-Sea Urban District Council, died recently, we regret to state, at the early age of thirty-four. He had only held the post since August, 1914. His municipal training commenced at Uxbridge under the late Mr. J. Freebairn Stow, to whom he was articled, and after being assistant surveyor there he was appointed chief assistant surveyor to the Staines Urban District Council. Subsequently he proceeded to Kettering as chief engineering assistant, and thence to Cheltenham, obtaining in 1908 the post of deputy borough engineer at Margate. Mr. Sawdon, it may be recalled, contributed a paper—dealing with the municipal works of St. Annes—to the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool, and his district was among those visited by the members of that body during their stay at the famous Lancashire holiday resort.

FOR OTHER ADVERTISEMENTS
See End of Paper.

LEEK URBAN DISTRICT COUNCIL.
AMENDED ADVERTISEMENT.

Applications are invited for Surveyor's Temporary Assistant (ineligible for military service), with architectural experience.

Copies of three recent testimonials, and giving full particulars, age, experience and salary required, should reach me by noon on Tuesday, August 29th, 1916.

(Signed)
W. E. BEACHAM,
Engineer and Surveyor.

Town Hall, Leek.
August 16, 1916. (3,072)

Surveyors: Their Security of Tenure and Defence.*

By J. H. DREW, M.Inst.C.E.I., Borough Surveyor of Grantham.

(Conclusion.)

Probably one of the greatest levers in the plea for security of tenure is to be found in the reports made from time to time by the inspectors of the Local Government Board upon the sanitary circumstances and administration of many districts.

The author appends a few extracts from such a report following the inspection of an urban district having a population of over 7,000 and a rateable value of nearly £46,000.

"It is manifest from this report that the sanitary circumstances and administration of this district are not subjects upon which the urban district council are to be congratulated."

"Explanation is, it appears to me, to be found, at any rate in part—in the fact that small sanitary authorities generally, as also not infrequently larger similar authorities, do not possess in the persons of their members any having but scanty knowledge of sanitary law, sanitary requirements, or proper methods of sanitary administration."

"For education and guidance in these matters they must be dependent upon their officers, and the latter, if not trained and competent to advise and guide, or if wanting in influence to lead the authorities, fall short in one of their proper functions.

"Small districts cannot, of course, afford to secure the whole-time services of men of this class."

"It has to be borne in mind as regards small districts that personal relations between district councillors and friends and acquaintances are apt to interfere unduly with proper and impartial administration of those districts; now and again, indeed, there are found on such councils men who own property not always the best in the districts they represent—sometimes, perchance, almost the worst—and others who, being interested in building operations, are not enamoured of by-laws."

"When such conditions obtain the work of officials is always delicate, and sometimes their positions are rendered very difficult."

Here we have the concluding paragraphs of an official document, one only of many similar reports which could be found stored away in the pigeon-holes at Whitehall. Could any stronger evidence be procured in justification of the appointment of properly qualified and trained officials, and to give those officials, once their appointment is ratified by the Local Government Board, that protection and assistance which should be theirs, as Mr. Nisbet Blair has said, "Not as a favour, but as a right," to enable them to fulfil the duties cast upon them by Parliament impartially and conscientiously, and without fear or favour?

TYPICAL CASES OF PERSECUTION, ETC.

The author could give numerous typical instances which have occurred in quite recent times, where officials, and particularly surveyors, have been slandered, libelled, assaulted, maligned, harassed, intimidated and persecuted by vindictive councillors or those aggrieved, resulting in dismissal from office in some cases, and the loss of considerable sums in law costs in others.

Who knows whether it will be his turn next? Every member of the institution should be prepared and in a position to defend himself, and his honour, should he be assailed. The knowledge among councillors and the public that surveyors were so prepared would, in the author's opinion, be a great deterrent to those who think they can attack officials without hurt to themselves, under the guise of "privilege" and "fair comment."

The author submits that the best way to bring about Government action would be to follow the line of the National Union of Teachers, and get a large proportion of surveyors to combine for a common defence fund, which could most easily be done by taking out the litigation policy in Official Security, Limited. By vigorous litigation in the courts of carefully selected cases, public attention would be powerfully drawn to the worst evils of the present system, and such cases would materially strengthen the pressure on the Local Government Board. Medical men have such a scheme, and so have motorists in their automobile associations, and there is every reason why surveyors should be similarly protected. The National Union of Teachers have found such action gives a great measure of security of tenure. If this course is followed, the author is confident that members will have marched a long way towards the attainment of security of tenure.

The author contends that the more highly trained a surveyor may be, the more his difficulties in the smaller districts are often correspondingly increased. Many of the residents and councillors love the old régime, and if a surveyor endeavours to educate and guide his councillors and to influence them in the manner suggested by the Local Government Board, his conscientious endeavours and high motives solely in the interests of the authority which employs him are often wrongly interpreted as "officiousness," "red tape," "by-law craze," "too expensive ideas," or even it may be alleged by speculative or jerry builders that his request for adherence to the by-laws is done to stop private building enterprise in favour of municipal housing.

It is well known that some councillors are of opinion that the officials are appointed, not to advise or guide the council, but to carry out what the council tell them to do. This type of councillor in the smaller districts is a difficult and often dangerous person to tackle, and strongly resents the introduction of new methods or ideas into the township, which are quite the opposite to what he may have himself advocated for a long term of years as a member of the local board and later as a district councillor. What was satisfactory for such a councillor thirty years ago is still good enough for him to-day, although it is convenient for him to forget that new legislation, not made by the official of course, will not permit the latter to conscientiously discharge his duties, and at the same time ignore the principles which his education and training have taught him are those which should be followed in the interests of, and for the benefit of the community which he serves.

The author hopes that a determined effort will be made by all ranks to bring about the maturity of the desired end, and in the meantime that each individual will so protect himself that the conscientious discharge of his duties will not bring him penniless and ruined in his career to the feet of his aggressors.

> "'Tis not in mortals to command success;
> We will do more, deserve it."

[As will be remembered, Mr. Drew's paper was among those which were "crowded out" at the annual meeting of the institution at Blackpool, but a number of written communications, which we reproduce herewith, have since been received by the secretary.]

Mr. W. Matthews Jones (Chester) said that "security of tenure" could only be obtained by the Local Government Board having a full say in the appointment of officials; if this were not allowed then the whole thing would fall to the ground, because if the official expected the Local Government Board to protect him when the time came then it was also necessary that they should have some say in the appointment of such men. Further, how far was "security of tenure" to extend? Was it to be head officials only, or heads, deputies, first, second and third assistants, draughtsmen, wages clerk, &c., and if so, how were these to be defined? Because he could quite imagine that the Local Government Board would not care to be bothered with regard to the appointments of first, second and third assistants, &c. One way out of the difficulty was for the surveyor himself, instead of his council, to appoint such men. Another way was to have what one might term a "permanent" and a "temporary" staff, so that anyone being appointed could be told that for the first four years or so they would be considered as on

*From a paper submitted at the annual meeting of the Institution of Municipal and County Engineers.

the "temporary" staff, and at the end of this period they could, if they so desired apply to be put on the "permanent" staff, and the committee or council could then have a say in the matter and, if necessary, refer to the Local Government Board. It was also manifestly unfair that only medical officers of health and sanitary inspectors should have this protection, because the surveyor in many cases had to carry out the various sections of the Public Health, Private Street Works, and other local Acts, and this very often brought him into antagonistic relations with the members of his council, and the ratepayers generally, although he was only doing his duty in carrying out such Acts. He hoped that there would be a more combined effort to secure the objects for which all surveyors should strive—viz., "security of tenure" and "superannuation."

Mr. J. H. Walters (Congleton) said the members of the institution were greatly indebted to Mr. Drew for the valuable and succinct paper on "Surveyors: Their Security of Tenure and Defence," and it was to be regretted that it was crowded out at the annual meeting. A discussion on the subject would have, no doubt, brought out the views of many members on this burning question, which had been on their minds for many years; perhaps cleared up differences of opinion, points of difficulty, and paved the way to a practical scheme being evolved; more especially since the Local Government Board had recently declared themselves ready to issue an order at the termination of the war giving whole-time medical officers of health and inspectors of nuisances security of tenure. The Local Government Board had evidently come to the conclusion that if a medical officer of health or an inspector of nuisances was to do his duty without fear or favour he must have some protection from the vested interest which was sometimes brought to bear against him. Mr. Drew had very clearly pointed out that municipal surveyors were quite as much liable to attack as the medical officer of health or the inspector of nuisances. His arguments were fully substantiated by the recent case at Kingston. As municipal surveyors, all were well aware that few duties were more liable to bring them into collision with owners and occupiers than the lopping of trees and the cutting of hedges, dangerous buildings, means of escape in case of fire in factories, and a thousand and one other causes. All the discretion and tact possible would not sweeten the malevolently-inclined owner or occupier. Security of tenure was quite as much a necessity to the surveyor as to the inspector of nuisances. How often did one read in the principal Public Health Act: "Where on the report of the surveyor of the local authority"? He was asked to decide whether a house was properly and effectively drained, whether there was sufficient and proper sanitary accommodation in factories, whether a house had or had not a proper water supply, &c. &c., and all this after, perhaps, a report from the sanitary department; and was the surveyor not liable to be "slanged" at the sanitary department's expense for making a report that would compel the owner or occupier to dip their hands into their pockets? If the Local Government Board had these points put before them again by the council immediately the war was over, it would do much towards the desired security of office, and some consolation to the author of a most interesting paper.

Mr. Oswald A. Bridges (Bognor) wished to congratulate the author upon the very able paper he had provided for discussion at their annual meeting on a subject which widely affected the interests of every surveyor in the kingdom. No one realised their position more as regarded "insecurity of tenure" than he did, when he started his life as a "chief" surveyor twenty-three years before. He was compelled to save every penny he could to fortify himself against risk of this kind. Legislation should have been asked for years ago, to secure the tenure of office and superannuation of every surveyor. Surely if medical officers of health and sanitary inspectors enjoyed security of tenure of office, and Poor Law officers had superannuation, surveyors, who carried out quite as important duties, or even more important duties, should have the same consideration shown to them. It appeared to him that surveyors would not obtain these advantages unless they woke up and studied their own interests a little more. Now Mr. Drew had started the ball rolling again on this question, the question must be pushed forward on every occasion until success crowned their efforts. He was sure the institution would help them in every way and bring the matter forward when the war was over. The author had their best thanks for the pains he had taken in bringing the subject before them in such a masterly way.

Mr. A. E. Prescott (Eastbourne) said that many of the members of the institution attending the annual meeting at Blackpool were extremely disappointed that this admirable paper written by Mr. Drew was, so to speak, laid on the shelf, while considerable time was taken up by discussing the same old threadbare topics of less importance. Mr. Drew's paper was undoubtedly of considerable value, and was deserving of better treatment. He summed up the whole case in one sentence when he stated that the non-success of the scheme so far was entirely due to the inertia and indifference of the surveyors themselves. This was indeed true; otherwise a paper of such importance would have secured a hearing and not been crushed out by subjects which have been discussed *ad nauseam*. It was, however, apparent that one could not, in such strenuous times, expect members of Parliament or the Government to give consideration to the subject of "security of tenure." All efforts must be directed to keeping the old flag flying; but, recognising that the subject was of extreme importance, he would suggest for the president's consideration the convening of a special meeting during his year of office, to give the members a full opportunity of taking part in the discussion of Mr. Drew's paper. As the result of such deliberations a practical scheme might be evolved, and representations made by a strong deputation to the proper quarter.

Mr. G. B. Hartfree (Alton) said that he would like to quote a case that came under his notice several years back. Making a brief holiday, he called upon a borough surveyor, and met a man whose face bore the expression of one who had received his death-sentence. He soon poured out his woes; he had prepared a scheme of sewerage and sewage disposal, entailing the consequent increase to his work. Without in any way consulting his views, his council engaged a clerk of works to supervise the construction and who apparently had approved anything and everything. The surveyor's time was fully occupied elsewhere, and his councillors were evidently adepts at "badgering the surveyor," as the whole time his permanent works were in hand he was harassed in connection with routine work, making his supervision of constructional works impossible. The root of his troubles appeared to be entirely due to the fact that the council had not voted sufficient funds to execute all the works they required. The following are examples of what was witnessed: "Oh, Mr. A., you ought to have the watercart out in X-street at once." Five minutes later; "Mr. A., the house refuse has not been collected at my cottages in Y-street." Two minutes after: "Mr. A., I was down Z-street a short time ago, and the men are at a standstill awaiting the materials you promised to send." The irony of the affair was that the corporation possessed but one horse, and the surveyor was not permitted to hire any other. He showed some of the permanent works and pointed out lines that were neither horizontal, vertical, straight nor curved, and said that when he noticed these and called upon the contractor to alter them, he was informed that the clerk of works had passed them, and they would not be altered. His council were divided; some blaming the contractor, some of the clerk of works; several blamed the surveyor, none blamed themselves. Mr. Hartfree sympathised with his suffering colleague, but about three months after leaving his town was informed that he had become insane. It seemed that the subject of protection of surveyors did not receive attention at the annual meetings of the institution, and this neglect was entirely due to the indifference of the members attending. It was obvious that those present at such meetings had a good class of councillor to deal with, but this made it more important that thought should be given to brother officers less fortunate.

The President (Mr. J. S. Brodie) said the author deserved the sincere thanks of every member of the institution for the excellent paper which he had prepared on this subject. There could be no reasonable difference of opinion as to the advisability of some form of protection for public officials engaged in carrying out statutory duties. On the other hand, it was distinctly unreasonable, and, indeed, would

be detrimental to the public service, that members should possess professions amounting to a freehold in the offices which they filled. The evil of such a security was glaringly illustrated in the case of ecclesiastical appointments, and surely no one wished to set up a system of security which was seen to lead to such undesirable results. The author said very truly that "Union is strength," and a solution of this problem would be found by heartily supporting N.A.L.G.O. proposals for superannuation, and security of tenure would form a natural and fitting corollary to a satisfactory and compulsory superannuation scheme, and their efforts should be concentrated in that direction.

Mr. Drew said he was indebted to the president and those members who had so kindly taken the trouble to submit written communications upon his paper, and greatly regretted that it was not possible for a full discussion to take place at the annual meeting. He predicted the result long before the Blackpool gathering, and when he saw the paper had been given twelfth place in the programme he quite realised that, to use a racing phrase, the paper "would be left at the post." He trusted that his effort to raise a discussion on the subject would not have been in vain, and that such interest would be aroused among members that that inertia which had been so evident in the past would be swept away. He commended to the notice of members the attitude of the president on this subject; evidently Mr. Brodie was not a whole-hearted supporter of "security of tenure," but, being a gentleman well advanced, both in years and in the profession, he evidently attached more importance to superannuation. Perhaps if the president assented to Mr. Prescott's suggestion for a discussion of the paper on some future occasion, they would have the benefit of his views and those of others who might be pessimistic as to the results which would follow the attainment of "security of tenure." The author adhered to the opinion expressed in the paper that "security of tenure" was of more importance than "superannuation," particularly in the smaller districts. In reply to Mr. Matthews Jones, the author quite agreed that the Local Government Board should have a voice in the appointment to surveyorships, and this was pointed out in making reference to the qualifications required under the Labourers (Ireland) Act, 1906. The author was afraid that it would further complicate matters in the attainment of the object if all grades of a surveyor's staff were included in a scheme for "security of tenure," although the point raised by Mr. Jones was one which should have very consideration. Mr. Walters further substantiated his plea, and, had the discussion taken place, it was the intention of the author to make reference to specific cases of dismissal, persecution, libels, &c., which had taken place, but it would not be wise to publish such instances, as to do so might be harmful to any colleagues who might be interested parties. The Kingston case was a typical instance, and congratulations were due to Mr. Clucas upon the result. The author could appreciate to the full the hours of anxiety and worry which followed in the train of such vindictiveness and persecution. Mr. Bridges evidently knew what it was to feel that "insecurity of office" to which anyone was at any moment liable, and, if nothing more, the author would feel repaid for his trouble in the preparation of the paper if, as Mr. Bridges said, "it had started the ball rolling." Mr. A. E. Prescott very aptly weighed up the position, and the author would be pleased to fall in with his suggestion should an opportunity be given for discussion of the paper at some future meeting. Mr. Hartfree penned a very able picture showing but one of the many little incidents which occurred daily in the smaller towns and districts, when councillors and city fathers often took pleasure in badgering the surveyor in the manner indicated by Mr. Hartfree. Many an overworked and under-staffed surveyor had been "cornered" and brought to earth in that cruel and Hunnish manner.

Admiralty's Housing Scheme at Greenock. — The housing scheme which the Admiralty proposed to carry out at Gourock has now proceeded with, and in the meantime it has been decided to erect forty-eight cottages at a cost of about £20,000. Local enterprise has, for a variety of reasons, failed to make good the serious shortage of accommodation.

DE-TINNING COMPANY'S SCHEME.

LOCAL AUTHORITIES' SUPPORT.

Keen interest has been evinced by members and officials of public bodies in all parts of the country in our article of last week with reference to the forthcoming meeting in London at which the British De-Tinning Company, of 75 New-street, Birmingham, will explain their scheme by which local authorities, working in co-operation with that firm, will be enabled to dispose of the old tins and waste metals from refuse with greater profit to themselves than is possible under present arrangements. A very large number of inquiries have reached the company, and we are able to announce the following additional acceptances for the gathering:—

Dover—Alderman J. W. Bussey; Durham—Alderman Jonathan Samuel, M.P.; Guildford—Alderman Patrick, J.P. (chairman, Sanitary Committee); Reigate—Councillors F. E. Lemon (chairman) and E. S. Edge; Scarborough—Councillor Frank White (chairman, Cleansing Sub-Committee); Wood Green—Councillors A. E. Salt (chairman, Health Committee) and H. Muskett (chairman, Highways Committee); Woolwich—Councillor S. H. Cuff (chairman, Works Committee); Portsmouth—Councillor J. E. Pink (chairman, Drainage Committee); New Malden, Surrey—Councillor Woollacott (chairman of committee); Chesterfield—Councillor Geo. Clark (chairman) and Mr. William Tomlinson (manager, sewage disposal works).

Horsham—Mr. J. B. Morgan; Worthing—Mr. F. Roberts, borough surveyor; Chatteris—Mr. S. Hipwell, surveyor; Northampton—Mr. A. Fidler, borough engineer; Hereford—Mr. John Parker, borough surveyor; Itchen—Mr. T. A. Collingwood; Shorehamby-Sea, Mr. A. W. Nye, surveyor; Twickenham—Mr. F. W. Pearce, surveyor; Purley—Mr. Robert Chart, surveyor; Carshalton—Mr. Wm. Gale, surveyor; Birmingham—Mr. Jas. Jackson (superintendent cleansing department); Barnes—Mr. G. Bruce Tomes, M.INST.C.E., surveyor.

Towns which, if not represented at the meeting, are desirous of being furnished with a full explanation of the company's project with a view to co-operating, include Cheltenham, Burton-upon-Trent, Crompton (Oldham), Budleigh Salterton, Dawlish, Clayton (Bradford), Peterhead, Derby, Rhondda, Gloucester, Spenborough, Irvine, St. Helens, and Leatherhead.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR OF HIGHWAYS.—August 25th.—East Kerrier Rural District Council. £80—£100.—Mr. M. H. Truscott, The Square, Penryn, Cornwall.

HIGHWAY SURVEYOR.—August 26th.—Claypole Rural District Council. £150.—Mr. A. J. Franks, clerk, 24 Lombard-street, Newark.

SURVEYOR'S ASSISTANT.—August 26th.—Hemel Hempsted Town Council. £80 to £100, according to experience.—Mr. W. R. Locke, borough surveyor, Town Hall, Hemel Hempsted.

GAS AND WATERWORKS MANAGER.—August 28th.—Devizes Town Council. £200 per annum.—The Town Clerk, Devizes.

ASSISTANT ENGINEERS.—August 28th.—Port of London Authority.—Chief Engineer, 109 Leadenhall-street, London, E.C.

SURVEYOR AND INSPECTOR.—August 28th.—Seaton Delaval Urban District Council. £150 per annum.—Mr. W. D. Soulsby, clerk, 3 Stanley-street, Blyth.

SURVEYOR AND INSPECTOR.—September 1st.—Beeston (Notts) Urban District Council. £225 per annum.—Mr. W. H. Redgate, clerk, Bentinck Buildings, Wheeler Gate, Nottingham.

TEMPORARY ASSISTANT.—Somerset County Council.—Mr. Gordon R. Folland, acting county surveyor, 13 Chamberlain-street, Wells, Somerset.

OFFICIAL REPORTS.

The Editor invites readers to forward regularly copies of annual and other reports, for notice in the columns of "The Surveyor."

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

BANBURY.—August 19th. For converting a building into a fire station, for the corporation.—Mr. G. E. Wrigley, borough surveyor, Town Hall.

HOLLINGBOURN.—August 24th.—For rebuilding part of a bridge and erecting oak fences, for the rural district council.—Mr. H. J. Bracher, clerk, 33 Earl-street, Maidstone.

KILLARNEY. — August 25th. — For building 19 labourers' cottages, for the rural district council.—Mr. P. Carey, clerk, Board Room, Workhouse, Killarney.

Engineering: Iron and Steel.

SINGAPORE.—August 14th.—For the construction of a steel bridge, for the Public Works Department.—Chief Clerk, Colonial Engineer's Office, Singapore.

LONDON.—August 22nd.—For the supply of 1,000 forged steel driving wheel tyres, and 500 forged steel trailing wheel tyres, for electric tramcars, for the county council.—Chief Offices, London County Council Tramways, 62 Finsbury-pavement, E.C.

MANCHESTER.—August 22nd.—For the supply of hard-drawn copper trolley wire, for the Tramways Committee.—Mr. J. M. McElroy, general manager, 55 Piccadilly, Manchester.

KIRKCALDY.—August 22nd.—For the supply and erection of a wire fence, for the corporation.—Mr. W. L. Macnidoc, town clerk.

EDMONTON.—August 23rd.—For altering and erecting ironing and other laundry plant, for the Guardians. Mr. J. C. S. Mummery, architect, 13 Fitzroy-square, London, W.

ISLE OF THANET.—August 24th.—For the supply of two wrought-iron galvanised hot-water tanks, for the Guardians.—Mr. A. E. Fussell, Hill House, Minster, near Ramsgate.

MANCHESTER.—August 25th.—For the supply of high and low pressure steam and feed pipes, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Town Hall, Manchester.

LONDON.—August 29th.—For the supply of one 5-ton steam tractor and three 6-ton trailers, for the Metropolitan Asylums Board.—Mr. T. Cooper, acting engineer-in-chief, Thames Embankment, London, E.C.

DUBLIN.—August 29th.—For the supply of single-phase and three-phase meters, for the Electricity Supply Committee.—City Electrical Engineer, Fleet-street, Dublin.

MANCHESTER.—August 30th.—For the erection of a refuse destructor furnace, for the Board of Guardians.—Mr. J. Macdonald, clerk, Union Offices, All Saints, Manchester.

ROCHDALE.—For the supply of static transformers, for the Electricity Committee.—Mr. C. C. Atchison, Electricity Works, Dane-street, Rochdale.

Roads.

BERKHAMSTED.—August 21st.—For the supply of slag, for the urban district council.—Mr. J. R. Hadfield, surveyor, 135 High-street.

SCUNTHORPE.—August 30th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, 110 High-street, Scunthorpe.

HASLEMERE.—August 31st.—For the supply of about 800 tons (more or less) of 2-in. and 1½-in. broken granite, for the urban district council.—Mr. Howard V. Snook, surveyor, Council Offices, Haslemere.

BEDFORD.—September 4th.—For the supply of 1,750 tons of broken granite, 4,740 tons of ironstone slag, and 1,600 tons of ironstone slag tar-macadam, for the corporation.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall.

FOLKESTONE.—For the supply of flints and Kentish rag, for the town council.—The Borough Engineer.

Sanitary.

WIGAN.—August 21st.—For the supply of 250 galvanised sanitary pans, for the corporation.—Mr. W. H. Tyrer, town clerk.

TENDRING.—August 21st.—For the execution of scavenging and cleansing sewage tanks, for the rural district council.—Mr. A. J. H. Ward, clerk, 42 Church-street, Harwich.

WANDSWORTH.—August 21st.—For surface water drainage works at Wandsworth Cemetery, Magdalen-road, Wandsworth, for the borough council.—Mr. P. Dodd, borough engineer, 215 Balham High-road, London, S.W.

HARTISMERE.—August 31st.—For the construction of a sewer drain, for the rural district council.—Mr. H. Warnes, clerk, Council Offices, Victoria-road, Eye.

MOTTRAM-IN-LONGDENDALE.—September 9th.—For cleansing closets and ashpits, for the urban district council.—Mr. S. Hudson, inspector.

Stores.

ROCHESTER.—September 5th.—For the supply of road metal, brooms, horse hire, and tools, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of* SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance.

LEATHERHEAD. For the supply of 130 tons of 2½ in., 60 tons of 1½ in., 15 tons of ⅝ in. of slag macadam, and 8 tons of slag dust, for the urban district council.—Mr. S. R. Drake, surveyor:

Constable, Hart & Co., London.*—Slag macadam—2½ in., 17s.; 1½ in., 17s. 9d.; ⅝ in., 18s. 6d. Slag dust—14s.

H. L. Cooper, London.—Slag macadam—2½ in., 18s. 4d.; 1½ in., 18s. 9d.; ⅝ in., 19s. 4d. Slag dust—12s. 6d.

Tarmac, Limited, London.—Slag macadam—2½ in., 18s. 5d.; 1½ in., 18s. 11d.; ⅝ in., 19s. 5d. Slag dust—12s. 6d.

W. Prestwick & Sons, Dronfield.—Slag macadam—2½ in., 19s.; 1½ in., 19s. 6d.; ⅝ in., 19s. 6d. Slag dust—10s. 3d.

J. Wainwright & Co., Shepton Mallet. Slag macadam—2½ in., 19s. 6d.; 1½ in., 19s. 6d.; ⅝ in., 20s. 3d. Slag dust—13s. 6d

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

16.—Institution of Municipal and County Engineers: Southern District Meeting at Bristol.

21-22.—Municipal Tramways Association: Annual Meeting, Surveyors' Institution.

23.—Institution of Municipal and County Engineers: East Midland District Meeting at Melton Mowbray.

30.—Institution of Municipal and County Engineers: Eastern Sub-District Meeting (Suffolk, Norfolk, and Cambridge) at Stowmarket.

30.—Institution of Municipal and County Engineers: North-Eastern District Meeting at Wath-on-Dearne.

OCTOBER.

7.—Institution of Municipal and County Engineers: Meeting at Watford.

APPOINTMENTS OPEN.

SEATON DELAVAL URBAN DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR AND INSPECTOR OF NUISANCES.

The above-named Council invite applications for the joint appointment of Surveyor and Inspector of Nuisances from persons ineligible for Military Service. The appointment will be made for the duration of the war only. The person appointed will be required to fulfil all the prescribed duties of Inspector of Nuisances under the Public Health Acts and regulations made thereunder, and to act as Inspector under the Housing and Town Planning Act, 1909. Salary as Surveyor £50 per annum, as Inspector of Nuisances £100 per annum; total, £150 per annum. The Certificate of the Royal Sanitary Institute will be a recommendation. The person appointed will be required to reside within the district, and to devote the whole of his time to his duties. The appointment will be made subject to the sanction of the Local Government Board. Applications, setting out age, experience, and qualifications, and endorsed "Application for Surveyor and Inspector," should be sent to me at the undermentioned address so as to be received not later than Monday, the 28th August, 1916.

Canvassing will be a disqualification.

Dated this 14th day of August, 1916.

W. D. SOULSBY,
Solicitor,
Clerk to the Council.

3 Stanley-street,
Blyth. (3,071)

The Surveyor

And Municipal and County Engineer.

Vol. L. AUGUST 25, 1916. No. 1,284.

Minutes of Proceedings.

The Repair of Railway and Canal Bridges.

Among the various problems to which the advent of motor traffic has given rise, the question of the standard of repair for bridges carrying public highways over railways and canals holds a prominent place. In this matter the obligations of railway companies and canal companies respectively stand upon a somewhat different footing. As to railways, it is provided by sec. 46 of the Railway Clauses Consolidation Act, 1845, that bridges for carrying public roads over the line, with the immediate approaches and all other necessary works, shall be "executed" and at all times thereafter "maintained" at the expense of the railway company. With respect to canals there is no general Act, but the special Act authorising the construction of a canal usually contains provisions for the construction and maintenance by the canal company of bridges carrying roads over the canal, and, even in the absence of any such provisions, it has been held that a canal company which under the powers of its special Act severs a highway is bound, at common law, to make and maintain a bridge (*R.* v. *Kerrison*, 3 M. & S., 526). But what is the extent of the obligation?—or, in other words, the standard of repair? That is the question which the motor, and more especially the heavy motor, has brought to the fore. Is the standard to be taken to have been fixed once for all, at the time the bridge was built, in accordance with the requirements of the traffic reasonably to be expected to use the road at that (possibly remote) date? Or is it, on the other hand, a standard varying from time to time according to the requirements of the actual traffic of the day—in other words, an "up-to-date" standard?

It was in reference to canal bridges that the question first came before the Courts, in the case of *Attorney-General* v. *Sharpness New Docks, &c., Company* (77 L.J., 121). This company's special Act, which was passed in 1791, provided that they should not make their canal across any public highway until they should, at their own cost, have made such bridges over the canal of such dimensions and in such manner as the commissioners appointed under the Act should adjudge proper, and that they should keep such bridges in "sufficient repair." The canal was made in 1912, and bridges were constructed to carry several highways over it. Mr. Justice Phillimore thought that the standard of repair was to be measured by the traffic which was ordinary on the highways at the time the bridges were made. But he was overruled by the Court of Appeal, who held that the statutory obligation of the company was to support and repair the bridges sufficiently to bear the ordinary traffic which might reasonably be expected to pass along the highways according to a standard varying from time to time, sufficient to carry the traffic of the day. Shortly after this decision the question was raised with respect to a railway bridge in *Attorney-General* v. *Great Northern Railway Company* (noted in vol. xlv. of THE SURVEYOR, at p. 1059). In that case Mr. Justice Warrington decided in favour of the up-to-date standard for railway bridges, and that standard was consequently looked upon as established for both classes of bridge. Subsequently, however, the Sharpness New Docks case was carried to the House of Lords, who reversed the decision of the Court of Appeal and decided for the fixed as distinguished from the up-to-date standard so far as the bridges over this company's canal were concerned. Of course, strictly speaking, this decision could not be regarded as a precedent applicable to railway bridges, nor even to all canal bridges, since it was arrived at having regard to the wording of this particular company's special Act. Nevertheless, *post hoc* (and in this instance probably *propter hoc*), the Great Northern Railway Company appealed from Mr. Justice Warrington's decision, and the Court of Appeal, apparently considering that the case was governed by the decision of the House of Lords in the Sharpness New Docks case, allowed the appeal, thus creating a precedent for the fixed standard in the case of railway bridges. Their decision has recently been affirmed by the House of Lords, the majority of whom appear to have considered that their hands were tied by their own decision in the previous case. It is very interesting, however, to note that there was one dissentient voice in the House—viz., that of Lord Haldane, who was strongly in favour of the up-to-date standard. In giving his reasons for this attitude, his lordship said that he was a party to the decision in the Sharpness New Docks case, but that that was a decision on a statute differing substantially from the private Act they were then considering—*i.e.*, the Great Northern Railway Company's special Act, which incorporated the Act of 1845. He was quite unable to read the judgment of the House in that case as having done more than interpret a particular set of words. As was pointed out by the Lord Chancellor in the course of his judgment, the question is undoubtedly one of unusual importance. "On the one side," said his lordship, "it involved an undoubted limitation of the rights of user of public roads carried by a bridge over the lines of a railway company, and on the other it might throw on railway companies the obligation to reconstruct such bridges to meet the growing demands of heavy modern traffic. The circum-

stances in which the case had arisen must exist in many instances, and they were likely to increase."

Looking at the matter not so much as a question of the interpretation of particular words in a statute as one of general principles, it appears to us that the up-to-date standard decidedly ought to prevail. If companies are allowed, for purposes of their own, to interfere with a public highway, it is surely only bare justice that they should remain under a continuing obligation to do whatever may from time to time be necessary to ensure that the public shall be in no worse position with respect to the use of the highway than they would have been in but for such interference.

* * *

Higher Engineering Education.

The higher education of the engineering assistant or young practising engineer is a problem which has perhaps been considered on broader lines in America than in this country. Here there is practically no alternative to the evening class, and even this is only possible for those who are fortunate enough to be within the reach of one of the large centres of population. In America there is a "Society for the Promotion of Engineering Education," and at a recent meeting of this body Mr. A. H. Blanchard read a paper on "Graduate Courses for Practising Engineers." The idea of these courses is that the practising engineer should be able to avail himself of the advantages of training at a modern university, including residence, with a minimum interference with his professional work.

As an example of a plan which has worked out satisfactorily in supplying the demand for graduate courses for practising engineers, Mr. Blanchard gave some details of the graduate course in highway engineering at Columbia University. The objects in view in founding this course were to elevate the profession of highway engineering in America to the plane of the National Department of Roads and Bridges of France, and to provide an opportunity for men engaged in highway work to obtain advanced instruction and training under favourable conditions. For many reasons it is fortunate that the first course of this character was established at a university presided over by a president and trustees who look upon the work of the university from an exceptionally liberal standpoint. While maintaining the high character of all degrees conferred, these men believe in opening the courses of instruction to any mature man, provided he has sufficient qualifications to enable him to derive benefit from any given course. Likewise it is fortunate that the administrative authorities allowed the introduction of an innovation as far as the period of attendance is concerned. The arrangement of the graduate work so that the several courses can be taken by engineers, chemists, highway officials, and others desirous of securing advanced instruction in highway engineering under favourable conditions has been fulfilled by, first, giving all graduate courses in the period when it is practicable to secure leaves of absence, and, secondly, by giving each course in a period of from two to three weeks in duration. This latter arrangement enables men who are particularly interested in certain groups of subjects, or who are not able to be in attendance for the entire winter session, to take any desired courses. The university requires that each candidate for the Master's degree shall be in residence for one collegiate year or eight months. Candidates for the Master's degree in the graduate course in highway engineering may fulfil this requirement in one of three ways—first, by being in residence for one collegiate year, or from October to May inclusive; second, by being in residence for two winter periods from December to March inclusive; or, third, by the distribution of residence over several years by being in attendance for parts of three or more winter periods. We cannot help thinking that, if some of our "modern" British universities could see their way to make similarly elastic arrangements, the opportunities thus afforded would be eagerly seized by many young engineers who cannot afford the luxury of residence for any extended period.

* * *

Road Direction Signs.

The paper on "Road Direction Signs," submitted by Mr. C. H. Cooper, the borough engineer of Wimbledon, at the recent annual meeting of the Institution of Municipal and County Engineers, and reproduced elsewhere in this issue, though very short, is a useful contribution to an important branch of the road surveyor's work. The need for improved signs in these days is admittedly great. The change from animal to mechanical traction has so enlarged the area that vehicles can cover in the course of a day that drivers do not now possess the intimate acquaintance with the district they traverse that they formerly possessed. The speed at which they travel is considerably greater, and calls for better and more distinct signs than the old-fashioned signposts placed at cross roads or the junctions of roads. Although there are many good road maps published both for cyclists and motorists, it is not everyone that is capable of readily reading such maps; and in any case, good direction signs are much more useful and convenient to the majority of road users than the best map published.

Mr. Cooper is not only of opinion that more information is necessary, but that a signal should be given to drivers when they approach a crossing or junction of the road before they reach these points. He would supply this information either by means of a semaphore plan or an actual plan. If a semaphore plan is adopted, a plan of the crossing or junction is placed in each road leading to them at a distance of 100 ft. from the crossing or junction. The sign would give on the top line the name of the principal town to which the road leads and its distance, and on the bottom line the name and distance of the nearest village. The letters would be 3 in. deep, which would enable them to be read at a distance of 200 ft., or 300 ft. from the crossing. Complete plan signs would be more useful in many cases, but are not likely to be of such general service as the semaphore plan. Lantern signs in towns are now being very generally used at dangerous cross roads, and they have the great advantage of being visible by night as well as by day. When a single-sign lantern can be seen from all the roads approaching a crossing, Mr. Cooper suggests that a lantern should be placed with a face opposite each road, with a plan of the crossing on each face of the lamp as seen from the particular road that the lantern is opposite. The illustrations given in the paper show that if his system were generally adopted driving would be made much safer and pleasanter.

* * *

Official Salaries at Southend.

Officials who are "invited to make a sacrifice during the war" equal to a reduction of 20 per cent on their salaries may well pray to be saved from the tender mercies of the war-time economist, but happily the servants of the Southend Town Council will not be under the necessity of making any such supplication. The proposal, emanating from the Economy Committee, though made quite seriously, found only two supporters at the town council meeting, and thus died a natural death. It is true that the self-denying ordinance was intended to apply to salaries exceeding £200 per annum, and that in no case was the

total salary of an individual to be reduced below £200; but even so, the diminished purchasing power of the sovereign was a factor which must inevitably apply to the official as well as to the workman, and it appeared that the latter had been helped in part to meet his growing outlay by the grant of a war bonus. Moreover, there was an obvious lack of equality in the application of the suggested sacrifice, for if a reduction of 20 per cent might be considered fair in the case of an officer receiving, say, £1,000 a year, would not the same percentage be excessive in the instance of another receiving £250? Another consideration which ought not to be overlooked is that it would be something of an anomaly on the one hand to appeal to individuals to make every effort to save from their incomes with a view to investing money in some of the financial schemes for assisting to carry on the war, while at the same time it was proposed so to reduce the income as to render even small savings impossible. While a good deal may be said for suspending the process of automatic increases of salary during the war, an invitation to sacrificial reductions is merely suggestive of eccentricity on the part of those who make it.

* * *

Surveyors and Petrol.

A fortnight ago we ventured to suggest that in the allocation of petrol supplies which has been undertaken by a committee on behalf of the Government special consideration should be given to highway surveyors. Many of these officials are in charge of large districts that can only be administered efficiently with the aid of a car, and the work that they are doing is unquestionably of the highest national importance. But apparently nothing is to be done, for the present at all events, to increase the very inadequate allowances that have been made. Some days ago it was reported that the Board of Trade would consider the claims of assistant county surveyors for additional petrol allowances. Judging, however, by the reply to a question on the subject in the House of Commons last week, the result of this consideration is not encouraging. The question was asked by Mr. Robinson, who enquired of the President of the Board what special allowance of petrol is made to county surveyors, road surveyors, and chief constables of large counties whose duties entail the travelling of great distances; and if some extra allowance can be granted them out of the reserve held. The reply was that arrangements have been made under which chief constables will be allowed their full requirements of petrol up to 30 gallons a month, and in certain cases more than this amount, but that it has not been found practicable at present to make any special arrangements for county surveyors and road surveyors. One official informs us that he has written to the secretary of the Petrol Control Committee, but without result, or even reply. Perhaps an inquiry from one of the institutions representing municipal engineers would receive more prompt attention.

* * *

Cost of Road Upkeep.

It is interesting to read, and compare, some of the reports recently issued by various county and municipal surveyors with regard to the cost of road maintenance during these somewhat abnormal times. For instance, the nett cost in Northamptonshire appears to have been about £103 per mile, and for the roads directly maintained by the county council only about £44 per mile. In Warwickshire the cost has been £91 per mile, which, rather curiously, is the same figure as reported from Somerset and Newcastle-on-Tyne. In Pembrokeshire the cost is given at £58 per mile. In Skegness, Lincolnshire, the cost per mile was £63. In Herefordshire for rural main roads it was £63, and for urban main roads £176 per mile. It is unnecessary to pursue the figures further, but it is evident that very little, if anything, can be gained by an attempt at making any useful deductions from these figures. So much depends upon what is included in the figures thus given, the widths of the metalled portions of the roads, the condition in which they are maintained, and the nature of the traffic on them, and a host of disturbing factors make it impossible to use the figures to any advantage. For instance, it is very misleading to compare the annual cost of upkeep of the roads in a county or urban district where large capital sums have been expended in improving the surfaces of the roads with that in a county or district where very little, if anything, has been spent out of capital, just as it would be of little use comparing the figures of one district where the traffic is very heavy with those of one where it is very light. Road statistics to be of real value should be accompanied by the fullest information on these important points.

* * *

War and Waste.

Have the general public in this country yet realised that they could give the nation enormous help in winning the war if they would only make up their minds to stop all waste? This fact is brought home to us when we read that Liverpool will be obliged to construct a third pipe line from Lake Vyrnwy, owing to waste of water by their consumers, which the water engineer confesses he is unable to check or minimise owing to the depletion of his staff. The same culpable waste is stated, in a recent issue of a northern contemporary, to be going on at Blackpool, Fleetwood, Lytham, and St. Annes. A similar state of things prevails at Dawlish, in Devonshire, and indeed practically all over the country. This misuse of water is proverbial, and arises from neglected defective fittings, careless or wilful running of water to waste, the too-frequent employment of the garden hose, and in numerous other ways. When it is considered that every gallon of water wasted is costing money to supply, and that this money must come out of the consumers' pocket in the long run, it seems incredible that the public should be so short-sighted. It is certainly to be regretted that at the present time, when every penny saved means so much to the country, people should be so careless in their use of water. There have been a great many crusades against abuses of various kinds. Why should there not be one against this crying evil? It is for municipalities and their officers to consider what action is possible in the matter.

* * *

The Outlook for British Engineers in Canada.

Is it not possible that when the Great Crisis is over many of our returned engineers may look to Canada as a fertile field for the exercise of their professional skill? If so, our advice to them would be, emphatically, Don't! We have it on excellent authority that most of the towns and cities there have spent so much in the past, and the war has caused such a great set-back, that it will take a long time for them to revive the stage when the services of consulting engineers will be needed frequently. Moreover, practically all the plums in this line are given to American engineers. For many reasons there is a strong tendency to select them, while the next choice falls to Canadian-born engineers. It is generally held that American methods and ideas are best suited for Canada, and no doubt this belief is sedulously fostered by interested Americans. Anyhow, men from the Old Country are not encouraged, and it is well this should be put plainly.

Air-Diffuser Experiences with Activated Sludge Tanks.

[In the following article, which we quote from New York "Engineering News," differences of experience and opinion as to the use of porous-block and perforated-pipe diffusers for intimately mixing air and agitating sewage in activated sludge tanks are expressed by engineers in charge of test and working plants in various American cities, including Milwaukee, Baltimore, Brooklyn, Cleveland and Chicago.]

In the design and operation of activated sludge tanks questions that have received considerable attention and will probably be given much more are the possible clogging of the "filtros" or other porous blocks used for diffusing the air as it is forced into the bottom of the tank and up through the sewage, and the relative advantages of porous-block and perforated-pipe diffusers.

It is well known that in other mechanical operations where a large volume of air has to be forced through restricted passages the latter become clogged with dust and dirt, and must be regularly cleaned or the flow of air will be interrupted; at least, this will happen unless the air is first washed or otherwise cleaned of dust. To what extent is this same trouble likely to arise in porous diffusers in activated sludge tanks? In dealing with this general question in the discussion relating to experience at Milwaukee there appeared in *Engineering News* of February 10, 1916, in the course of some remarks by T. Chalkley Hatton, a statement that there was no trouble from clogging in the large tanks at the Milwaukee testing station. The air, however, is filtered through Excelsior placed in the air-feed pipe. The experience at Milwaukee also showed that there was no trouble during nine months' operation from filtros block clogging from the sewage itself.

Subsequent to the appearance of the article on the Milwaukee plant, a member of the editorial staff of *Engineering News* visited the large Imhoff tank at Baltimore, where, under the direction of Mr. Calvin W. Hendrick, chief engineer of Baltimore, and Mr. Leslie G. Frank, sanitary engineer, United States Public Health Service, one of the large new Imhoff tanks has been adapted to serve as an activated sludge tank. The experiences at Baltimore being somewhat at variance with those at Milwaukee, it seemed desirable to appeal to the engineers who have been most intimately connected with activated sludge work in the United States, asking them to summarise their experiences with air distribution in its relation to clogging of porous distributors. The responses to this request have brought out some interesting facts regarding perforated-pipe as well as porous-block distributors. Below are printed notes on the Baltimore plant kindly revised by Mr. Hendrick and supplemented by Mr. Frank, together with notes from various other localities and engineers.

BALTIMORE NOTES: REVISED BY MR. HENDRICK.

The air supply at Baltimore, before passing to the blower, is thoroughly washed to remove any dust it may contain. This washing is effected by passing the air through a 12-ft. length of a 12-in. cast-iron pipe set vertically. The air enters at the bottom and passes upward through gravel with an approximate diameter of ⅜ in. This gravel layer is supported 18 in. from the lower end of the pipe by a grid and extends to within 3 ft. of the top of the washer. A small stream of water is trickled through the gravel from the top and is taken off at the bottom by a float-actuated valve. The air at Baltimore is compressed by a rotary compressor having an eccentric rotating piston that requires a great deal of lubrication. Notwithstanding the thorough washing that the air receives before going through the blower, there has been found on the inside of the porous blocks* a deposit of oily sludge. This, it is supposed, comes from the lubrication process already mentioned. It is hoped that the oily deposit in the blocks can be avoided by substituting a rotary compressor of the gear type, or a high-pressure centrifugal blower (neither of which requires internal lubrication), for the kind of blower referred to above.

MR. FRANK ON EXPERIENCE AT BALTIMORE.

The diffuser grid installed in the activated sludge tank was first provided with carborundum discs, grit 120, the influent air being washed as is described above. Two facts soon become evident—that an oily sludge accumulated on the bottom surfaces of the discs, and that the air washer removed practically as much oil without the water stream as with it. The whole gravel layer soon became heavily coated with an oil film, and this oil film was as good, or probably better, than a water film for the removal of dust and oil particles. Neither oil film nor water film, however, removed the oil vapour that had been generated by the heat of compression, the air detention period in the washer being insufficient to effect its recondensation. This oil vapour, therefore, passed down into the manifold and condensed on the cold under-surfaces of the diffusers, gradually forming a sort of oily sludge compost with the particles of sludge that worked their way into the grid in times of shut-off. This oily sludge rendered the carborundum discs almost impervious to air and caused us to substitute filtros therefor. The same accumulation of oily sludge has been observed on the underside of the filtros plates, but owing to the greater porosity of this material the corresponding increase in resistance has not been so great as in the case of carborundum.

At present (April 29th) the air compressor capacity is being greatly increased by the installation of a Connersville blower, and it is hoped that at the same time the oil difficulties will be obviated, due to the fact that this type of blower requires no internal lubrication, as in the case of the blower heretofore used.

Since the above was put in type, Mr. Hendrick informs us, under date of July 11th, that a Connersville blower, with a capacity of 195 cub. ft. of fuel air per minute, has just been installed and the porous area of the grill has been doubled. Experiments on this installation have just began.

MILWAUKEE.

(Mr. T. Chalkley Hatton, Chief Engineer, Sewerage Commission, Milwaukee, Wis.)

As to the experience of Milwaukee, I might repeat the statement in *Engineering News* of February 10, 1916, in which I said that no trouble from the clogging of the filtros plates had been so far experienced at the Milwaukee testing station—that is, clogging due to the passage of the air through the plate. We have occasional clogging on the top of the plate, owing to the very heavy sludge temporarily alighting thereon and not being lifted through the body of the liquor.

We think this is due to the character of our sewage in that it carries a great deal of waste, entrails from the packing-house district, small pieces of leather from the tanneries and large quantities of hair. All this becomes massed together. The specific gravity, being thus largely increased, overcomes the tendency of the air to keep such masses in constant suspension. We think much finer screens than we now use will largely overcome this difficulty.

The Connersville blower which we are operating was designed with a view of preventing any lubricating oil used in the blower from getting into the discharge pipe, and the wood wool placed compactly in the filter seems so far to have intercepted the dust carried by the air.

While we have not removed any plates that have been in operation more than two months, there is no visible evidence in the operation of our plant that these plates are not giving just as good diffusion as when they were installed. Two months after our new and large fill-and-draw tank was first placed in operation we did remove some of the plates from it and carefully examined them for porosity. We found that they were in the same condition in this respect as when they were first introduced.

From the notes furnished me of the Baltimore experience, I should attribute the trouble to the lubricating oil from the compressor. This would not be entirely removed by the washing of the air. In fact, I do not place as much dependence upon the washing of the air as upon a good filter. Whether

* Carborundum discs of 120 grit were first used, but the differential pressure required to force the requisite amount of air through rose so rapidly (from less than 1 lb. to over 5 lb. per square inch) on account of clogging that filtros was substituted.

the wood wool is the best medium for this filter or not I am not prepared to say, but so far it has been successful with us. It is cheap, easily examined, easily removed and replaced.

We are now experimenting with a diffuser made of basswood, cut at right angles to the grain. We have made several experiments on woods of different characters, but fine basswood, so far, is the most reliable and gives the best diffusion with the least frictional loss. The air appears to be uniformly distributed in smaller bubbles than from the filtros plates, but whether the wooden disc will prove practical or not is a question yet to be determined.

We are trying 8 by 10 in. plates to determine, among other things, the total swelling of the wood, the uniformity of porosity during long-time service and the possibility of decomposition through aërobic action or through chemical action due to contact with the sewage. These, of course, are matters that can only be determined after considerable careful investigation.

BROOKLYN.

(Mr. George T. Hammond, Engineer of Design and in Charge of the Sewage Experimental Plant, Bureau of Sewers, Brooklyn.)

The activated sludge method of sewage treatment is so recent that it is not surprising if we have not yet learned the best technique of applying the principle in actual practice. The first experiments were made on a laboratory scale, or with apparatus designed for other methods of treatment, which could be modified for immediate use in temporary experimental plants. Resort to the actual trial of apparatus was the best, if not the only, way to gain essential working knowledge before serious problems in design could be undertaken; and, indeed these trials and experiments are as yet unfinished, and it is still too early to anticipate their results.

It is scarcely a year since the first plant on a working scale was put into service. While we may not forecast results, it is quite safe to hazard the opinion that several years must elapse before sufficient data of a satisfactory kind will be secured to permit an adequate solution of some of the problems presented. Considering the short time that has elapsed, it is rather surprising how much progress has been made.

Air diffusion into the sewage has been attended with considerable trouble, and affords one of the main problems involved in the application of the method.

The ideal air diffuser should give an easily controlled flow and volume of air, equally diffused to all portions of the tank, with bubbles of the "critical" size formed at the points of entrance. It should not tend to become clogged, or at least should not tend to unequal clogging. It should be readily cleaned in place without emptying the tank, or should be easily removable for replacement and for cleaning in case of clogging. It should show the minimum deterioration in service, and its cost should be reasonable.

The earliest aërator tanks of which the writer is informed employed grids of perforated pipe for this purpose. The experiments of Black and Phelps in Brooklyn were conducted with such grids, as was the continuous-flow aërating tank experimented with in 1914-15 at the same place. These grids have uniformly given good service, if designed on correct principles, and have shown but little tendency to become clogged.

Porous material used to diffuse air has shown a tendency to progressive clogging. This may possibly be reduced to a minimum by various forms of air filters, placed in the supply line, which promise to render its use practicable. It has been employed because it gives a very fine bubble, and the entering bubbles are distributed over a wide surface. While clear and new, it gives the air diffused a higher efficiency than does the perforated grid. But, in spite of every care, this freedom of discharge and high efficiency seem not always to be maintained. From whatever reason, some of the porous plates come to pass the air less freely than others. Examination of a number of tanks supplied by air in this manner convinced the writer that there was in every instance a material variation in the diffusion of the air in different portions of the same tank. This was evidenced by violent local ebullitions and evident local streaming out of air, while other portions of the tank surface remained quiescent, or nearly so. Photographs taken of the surfaces of a number of these tanks sustain this observation.

It was also observed, where this phenomenon was seen, that for one or another assigned reason the aëration period had been, in all the cases observed, materially lengthened. This result was quite in accordance with the writer's own experience with the use of porous diffusers. We found that our discs clogged very unevenly and that the entire supply of air was discharged through the unclogged disc without showing any decrease in quantity by meter.

It seems obvious that the primary cause of this trouble is the fineness of the pore, or passage, through which the air is diffused. Even if all dust and other foreign material are excluded by means of air filters, various kinds of bacterial and other minute forms of life, &c., enter freely and may cause obstructing growths. The sewage directly over such plates may enter the pores and cause obstruction in various ways, among which may be mentioned deposits of mineral matters from solution. In short, there are many ways by which porous material can become clogged, even if the greatest care is taken to prevent it.

In view of the foregoing, it seems desirable to find some other method of diffusion. Apparently, the porous material answers only one of the above-mentioned ideal requirements of a distributor—that of giving a very fine size of air bubble.

Experiments have shown that the finer the bubble the more the pressure needed to distribute the compressed air and the greater the danger of clogging. The finer the bubble the greater its efficiency, but the more expensive the air. The tank efficiency is highest when its reliable average performance gives the effluent required at the least expense for air.

The experiments conducted in Milwaukee in 1915, reported by Mr. Hatton, seem to indicate that the porous material was rather the best for diffusing air, although he states that "there appeared to be little difference in the character of effluent obtained by the same volume of air, whether it was applied through an open jet or a filtros plate."

It seems to the writer, in view of this and his own experience, that the use of porous material for diffusion has largely grown out of theoretical rather than practical considerations, and that further experimental work is very desirable. The useful age of service to be expected from a porous substance, it would seem, must be comparatively short, if we can depend upon our experience in other lines of work.

Our experience in Brooklyn has been in favour of the perforated grid, the pipes of which are placed not more than 12 in. apart and the perforation made of $\frac{1}{8}$ in. diameter, 6 in. c. to c. The grid in one tank aërator is still in service after over two and a half years, during which time it has had no cleaning. The depth of sewage aërated is 22 ft., and the distribution is very good.

Another tank, in which distribution was provided by porous discs, was not so satisfactory on account of clogging. The phenomenon of clogging in this tank was rather interesting. Some of the discs clogged, while others did not. As a result, a greater volume of air entered through the unclogged discs, causing intense local surface ebullition and streaming out of air, while at other places the surface was quiescent. As there is always an excess margin of working pressure, increased volume of flow can readily occur through the unclogged diffusers; thus the entire metered flow of air will still continue to enter the tank, but it may not reach half of the sewage, and much of it escapes by streaming. Why employ the porous material, to obtain the most efficient size of bubble, in order to save a small percentage of the air, if, as a result of the attempt, clogging or uneven distribution may occur and waste far more than could be saved by this means?

Unfortunately, there seems to be no satisfactory way to clean out the porous discs or plates without removing them. This problem has been ingeniously handled at Baltimore, where the diffuser discs are mounted on a framework of pipes that may be closed like an umbrella and the entire mechanism withdrawn by a derrick. This enables the operator to remove and replace a disc at will; but where the porous plates are built into the bottom of the tank, as in some plants, it is too early to feel certain that they can be kept in good order. But as the surfaces of the air inlets must be as nearly absolutely level with each other as possible, it may be difficult to obtain this with a movable distributor.

In the design of a sewage disposal plant refinements in operating parts are undesirable. The

mechanism that shall give the most reliable average service will usually be selected. For diffusing air in a tank filled with sewage the writer's observation leads him, in the light of present knowledge, to prefer the perforated-pipe grid, although it will not give the most efficient size of bubble.

The grid may be so designed that, if necessary, it can receive frequent flushings from the city water supply, which always has a greater head than the sewage in the tank; and it can be provided with drains, so that it may be flushed out with little trouble, without emptying the tank. Should the perforations become clogged with grease the tank may be emptied and steam or hot water discharged through the grid. Possibly further experiments may modify this opinion, which is offered by way of discussion on experimental work still in progress.

The question has several times suggested itself to the writer, "Would it not be possible to get along with less air by the use of mechanical agitation in the aëration tanks?" It would seem that much of the air applied at present is wasted, as it is only applied to produce agitation—a churning movement that seems to aid coalescence of the finer particles of colloidal matter, and facilitates the activation treatment. This has not been tried out so far as the writer is aware, but various means suggest themselves, such as paddles, screw propellers, movable air distributors designed to agitate the sewage and to diffuse air, jets of sewage discharged into the tank, if the sewage enters by pumping, &c. May not such a method greatly increase the effect of air, which could then enter by means of a rather coarse movable or stationary grid and be mechanically mixed with the sewage?

The importance of continuing our experimental work with the activated sludge method of sewage treatment cannot be overstated, and every possible advantage should be taken of constructive criticism, as well as experimental work.

SANITARY DISTRICT OF CHICAGO.

(Mr. Langdon Pearse, Division Engineer, Sanitary District, Chicago.)

My personal experience with small experimental units was satisfactory, but in the plant put into operation by us in January, comprising four units, with a capacity of 35,000 gallons per day on a twenty-four-hour period, we have had considerable difficulty with the clogging of the plates. This apparently has been caused by the sewage, which contains a good deal of paunch manure, straw, hair and other material that will mat and clog. A recent examination of one tank with a nominal inside dimension of plan of 6 ft. by 23 ft., with a single row of filtros plates down the centre, indicates that all the plates have been broken. The breaks are apparently due to downward pressure. The plates were supported on two sides only, in wooden boxes, lined with galvanised iron, and were set in jointite. The use of wood probably caused the trouble, a more rigid frame being desirable. The distribution in the tank was seriously interfered with, a considerable deposit of hair and coarse sludge being found underneath the plates, many of which were badly shattered. We are endeavouring to find the exact reason for this difficulty, although it appears to be due to clogging and the loading of the water on top. No provision was made for back-flushing by water. For various reasons the air pressure has been shut off from time to time. The air distribution has been remodelled, the boxes being stiffened, and an additional support placed so that all plates are supported on four sides. This has proved satisfactory.

The air at our testing station is furnished by a rotary blower of the Connersville type, working against a 6-lb. head, the depth of water being 10½ ft. over the plates. We have a muslin screen on the intake of the blower. So far as we can ascertain, there has been no difficulty on the underside of the plates from any oily deposits, there being no trace of oil in the air boxes underneath.

In order to cure certain difficulties in measuring the air with a Venturi meter, a steel storage tank 5 ft. diameter, 5 ft. high, has been installed. This reduces the pulsating effect and forms a trap for oil or moisture.

Before our experiments are concluded I hope to run comparative tests on two tanks with perforated pipes and two tanks with filtros plates. I believe that considerable thought is still required to determine the proper design for the air-distribution system in order to make it satisfactory at a minimum cost.

I believe that *Engineering News* will do well to impress upon its readers the importance of going slow in the adoption of activated sludge plants without thorough consideration of all the elements involved, as I think most of us still agree that it is not a simple process to operate, but one whose entire limitations are not yet developed.

The cost problem is still in the air, particularly the cost of handling the sludge. Another warning should also be issued on the short-time tests lasting only two or three weeks, which are liable to give misleading results, as it takes several months in general to determine the efficiency and limitations of sewage-treatment methods definitely. We have noticed in our work that good results are obtained for the first three or four weeks, and then difficulties begin to develop that were not anticipated.

HOUSTON, TEXAS.

(Mr. E. E. Sands, City Engineer.)*

Our experiments were all conducted with that variety of filtros manufactured by the General Filtration Company, and known as Grade 5-1. The catalogue published by the company states that where there is a nett head of 2 in. of water the capacity of a filtros plate 1½ in. thick and 12 in. square is 360 cub. ft. of air per hour, or 6 cub. ft. per minute, and that the porosity of this plate or the percentage of voids is 37·56. It is evident that the tests from which this table was prepared were made with dry air and under dry conditions. When a filtros plate becomes wet the porosity is reduced and its resistance to the flow of air increases. Careful experiments were carried on with the filtros plate in tank No. 3. This plate was submerged to a depth of 7 ft. 6 in. The air as it entered the plate was measured through an orifice in a thin plate located in an enlarged section of the supply pipe. When the plate was new, 150 cub. ft. of air per hour (measured under a water pressure of 8 ft.) required a nett head of 6 in. After the plate had been used for thirty days in a tank operated on the fill-and-draw plan, it was found that the same amount of air required a nett head of 15 in.

After forty days' use the following heads were required, the depth of sewage in the tank still being 90 in.:—

Air in cubic feet per hour (measured under pressure)	Head of water. Inches. Total.	Nett.
50	102·2	10·5
75	102·22	12·22
100	104·1	14·0
125	105·82	15·82
150	107·53	17·53
175	109·20	19·20
200	111·10	21·10

Where the plate is in a fill-and-draw tank, every time the air is shut off a certain amount of sewage filters through the filtros plate back into the air pipe, and it is reasonable to assume that a small amount of sludge remains in the voids of the filtros plate and reduces its capacity.

Where a tank was used for a continuous flow, the resistance of the plate was not found to increase to any great extent, and it is believed that if a continuous-flow tank were supplied with filtered air the resistance of the filtros plates would remain nearly constant for any given climatic condition. It was observed, however, that the humidity of the atmosphere had a decided influence on the capacity of the plates. When the air was moisture-laden the resistance of the plates was greatly increased. For this reason the use of a cheesecloth filter for the removal of dust from the air will give more satisfactory results than the use of an air washer. Such a filter will not remove as much dust as a washer, but a washer will cause an increase in humidity, unless some cooling device is used.

Tank No. 3 was equipped for about ten days with an aërator constructed of small brass tubing. This aërator consisted of a central head from which there radiated in a horizontal plane eight ⅛-in. brass tubes 6 in. long. An aërator constructed in this manner would work in a continuous-flow tank without any trouble, but when it was tried on a fill-and-draw tank it was found that the small tubes clogged up when the air was shut off and the sludge allowed to settle. As the water surface in the tank was lowered during the operation of drawing down the tank, the air held in the supply pipe between the valve and the aërator expanded and slowly escaped. Then when the tank was refilled the sludge was forced into the aërator tubes, and considerable difficulty was experienced in keeping this aërator cleaned out and in proper working condition.

All the mechanical difficulties of this could have been overcome without much trouble, but results of

* The remarks here given are from Mr. Sands' annual report, dated February 1, 1916.

analyses made during the time this aërator was in use show a decided loss in efficiency. This is attributed to the fact that the air is not as finely divided by such an apparatus as is by the filtros plate.

It is apparent that the operation of any large tank containing a great number of aërators requires careful consideration of the following conditions: When the air is turned on a few aërators will handle a large quantity of air unless each aërator offers considerable resistance. This air will diminish the hydrostatic head over these aërators, and consequently increase the effective head on the particular ones that start to work first. To eliminate this possibility it is necessary that each aërator shall contain sufficient resistance to prevent a few of them from discharging all the air that is intended to be discharged by the entire system. In other words, a certain resistance to the flow of air is absolutely necessary to insure a uniform distribution. Where the tank is 10 ft. in depth this resistance should be such that a nett head of at least 6 in. of water is required to discharge the amount of air that the aërating plate is designed to provide. If a type of aërator were used that did not require a 6-in. hydrostatic head to discharge the required amount of air, some other resistance would have to be used at each aërator; consequently the resistance offered by the filtros plate is of no disadvantage until it becomes greater than 6 in. It is believed that a proper filtros plate can be selected for any particular design that will afford the right resistance to insure uniform distribution, but it is necessary that air should be freed of all dust, and that the tank should be worked as a continuous-flow tank, or the resistance of the filtros plate will gradually increase, with a resultant loss of power.

ARMOUR AND CO., CHICAGO.

(Mr. G. L. Noble, Engineer-in-charge, Union Stockyards.)

The filtros plates that we had in our tank were admitted by the General Filtration Company to be of uneven porosity, due to the manufacture by an outside kiln firm. This resulted in the very rapid clogging of the finer plates, and this method of distribution was abandoned.

Perforated pipes were promptly installed, and have given good satisfaction. They are made of ¾-in. galvanised iron, and perforated with $\frac{1}{25}$-in. holes, 2 in. apart, and staggered. Cleaning is necessary only once in four months, and this cleaning can be accomplished in short order without interfering with the operation of the plant.

We have carefully studied all the data available for comparing these two methods, and have yet to be convinced that a porous plate is preferable to perforated pipe, when the matter is considered from every viewpoint. We expect (July 3rd) to install perforated pipes in our large experimental plants.

CLEVELAND

(Mr. R. Winthrop Pratt, Consulting Engineer, Department of Public Service, Cleveland.)

We have been running now (July 3rd) more than five months, and as yet have noticed no trouble which might be due to clogging of filtros blocks.

We hope and believe that with our type of blower, containing as it does a water trap through which the air must go, there will be no serious trouble from dirt or dust in the air entering the activated-sludge tanks.

ILLINOIS WATER SURVEY.

(Mr. Edward Bartow, Director, State Water Survey.)

In our experiments, operating tanks on the fill-and-draw plan for about a year, we have experienced no trouble from clogging of the filtros plates. On the fill-and-draw plan, however, the pores are cleaned by downward flow of the water, while the air is shut off during the settling period.

In our continuous-flow plant, about to be put in operation, we expect to filter the air through cheese-cloth, and we have made arrangements so that the air may be shut off and the water allowed to flow downward through the plates into a space from which it can be pumped. We can tell better after operating whether our precautions are satisfactory, but we do not anticipate any trouble from clogging of plates by impure air.

Automatic Lighting in Birmingham.—During the year ended March 31st last states Mr. H. E. Stilgoe, the city engineer of Birmingham, in his annual report, the automatic lighting system was extended to the lamps (1,200 in number) in the King's Norton, Northfield, and Yardley areas, making a total of 2,630 lamps automatically controlled in the city.

ROAD TARRING AND FISH LIFE.

THE PROTECTION OF TROUT STREAMS.

At the last meeting of the Hampshire County Council the Main Roads and Bridges Committee reported the receipt of a petition from a number of persons interested in the local trout fisheries protesting against a proposal to tar the roads in the valley of the Test.

"It must be admitted," said the petitioners, "that fish life in several rivers in England has been destroyed by tar having been placed on roads adjacent to the rivers. We are aware it is now considered possible to deal with tar in such a way as to make it innocuous to fish life, and that it is now the practice to construct gullies by the sides of the roads to act as filter-beds, but there is no doubt that in times of heavy rain or floods these precautions are rendered useless, and the pollution, although it may not actually kill the fish in the river, is sufficient to destroy their natural food, which, in the end, produces the same result. It is sometimes forgotten that pollution is caused not merely by the tar with which the roads are sprayed, but by the accumulation of petrol and other refuse which is collected on the roads, and with the first storm washed either directly into the river or into the hundreds of streams and ditches which connect with it, and which often form the spawning beds of the trout and the sources from which their food is obtained. We should be unwilling to suggest that our personal interests should stand in the way of any important public interests, but we do venture to suggest that the slight public advantage which might be gained by the tarring of the roads in the district named is not sufficient to justify the risk which would be run, as the fishing in the river Test is really a national asset, and if the fish life in it were destroyed, or even materially damaged, it would cause great depreciation in the value of property over a considerable district."

The committee stated that a representation had also been received from the Test and Itchen Trout Fishing Association, with regard to surface tarring on any roads the surface water from which might flow into the Test, Itchen or Anton, or the streams flowing into these rivers. The main road which was affected, as far as the Test Valley was concerned, was the Romsey and Stockbridge main road. Every precaution, said the committee, had been taken to use only tar purified to a very high standard. It was now urged that no tarring should be undertaken which might have the effect of destroying insect life in the subsidiary streams, and thus reducing the amount of food available for the fish. Surface tar was applied only where the road had been coated with granite or other hard material; and as at the present time a small portion only of the Romsey and Stockbridge road was so coated, there would not, in any event, have been extensive tarring carried out there. At a meeting between the committee and the petitioners, an agreement was come to as to five lengths of road which should not be treated with surface tar for the present, and this arrangement would have resulted in 5 miles 1,000 yds. being available for tarring so far as it was coated with hard material, and 3 miles 400 yds. being left untarred. Since the interview the association had asked for a further modification as to some portions of the road agreed to be suitable for tarring, and the committee had directed the county surveyor to make a further report with regard to these.

Mr. F. J. Hendy said he did not think the health of the inhabitants should be sacrificed to the interests of sport and the fish. Those living near main and district roads had to close their windows owing to the dust nuisance.

Sir William Portal remarked that the recommendations had been associated with the fishers in the county, but others who were equally interested in the matter were not actuated by selfish interests by any means, as had been suggested.

Colonel Stratton Bates said he thought the community ought to come before fish. An owner of fish said it was perfectly ridiculous to suggest that tarred roads injured fish. Out of hundreds of trout he had caught not one was in the slightest degree affected, and those caught were in splendid condition. All the surface water drained into the river, which was the clearest evidence that the tar did not harm. The fear of tarred roads was very much exaggerated.

Captain Seward suggested that it would be best for

all concerned to direct their energies to a peaceful solution of the difficulty by adopting a substitute for tarring.

Lord Portsmouth, who is chairman of the Salmon and Trout Association, referred to the experiments which before the war were being conducted at Fishmongers' Hall to ascertain the effect of tar upon the life of trout. As the hall had been given up for a military hospital the experiments had closed. They had an extremely able and scientific committee, and the experiments would be resumed as soon as possible. There was no doubt that tar, as they knew it, was deleterious to fish, of which they had absolute proof. He agreed that the interests of the public must come first in the long run; but in this complicated question it would be unwise to rush into a question which might involve heavy litigation and expenses.

The report was adopted.

MOTOR TRANSPORT IN EAST SUFFOLK.

A YEAR'S WORKING OF PETROL AND STEAM WAGONS.

During the twelve months ended March 31st last the four motor wagons owned by the East Suffolk County Council were kept constantly at work, one being almost exclusively employed on the conveyance of materials for the improvement and construction of roads for the military authorities, and the cost of hire refunded by the War Department.

In view of the scarcity of materials this arrangement has, says Mr. W. Jervis, the county road surveyor, in his annual report, proved beneficial, owing to the shortage of supplies for main roads, as it has kept the wagons constantly employed.

The wagons have proved their value, particularly during the present crisis, when difficulties would no doubt have arisen in getting the material carted as and when required, owing to the scarcity of men and horses.

The following is a statement of the work done by each of the four wagons:—

—	No. 1 petrol motor wagon.	No. 2 petrol motor wagon.	No. 1 steam wagon.	No. 2 steam wagon.
No. of days working ...	298¼	300	279½	251
No. of days on which wagons were not working, due to holidays, repairs, also washing out in case of steam wagons	19¼	18	38½	67
Total mileage	13371·2	16039·4	9011·2	6589·2
Total tonnage conveyed...	638·7	970·9	578·2	480·2
Total ton mileage ...	25382·5	36346·4	16697·9	24889·8
Average mileage per working day	44·83	53·46	32·24	26·25
Average tonnage per working day	21·42	32·36	20·69	19·13
Average ton mileage per working day	85·10	121·15	59·74	99·16
Average distance from base to point of distribution	4·21	4·39	3·05	5·48
Average tonnage per journey	4·26	5·	4·19	8·12
Average ton mileage per journey	16·96	19·23	12·1	42·11

Note.—The figure of 67 days, representing the time not worked in the case of steam wagon No 2, is partly due to the fact that this wagon cannot run when there is snow on the road.

Scarborough Bathing Pool.—At a recent meeting of Scarborough Town Council it was reported that the success of the new sea bathing pool had been such that it would be necessary to provide additional dressing accommodation.

Water Diviner Wanted.—Hoylandswaine, Yorks, Urban District Council have expressed agreement with the view of the medical officer that a permanent supply of water for the whole area under their control should be obtained, but, states a report, "need the services of a water diviner to locate the source of such supply."

THE PROBLEM OF DRIFTING SAND AT RHYL.

A CANCELLED CONTRACT.

The surveyor to the Rhyl Urban District Council, Mr. A. A. Goodall, presented recently a report on the subject of preventing sand from the foreshore and sandhills drifting on to the parades and into the streets of the town. Last winter the drifts were so heavy on the Marine-drive and East Parade that the roadway was rendered impassable for about a quarter of a mile, and the council entered into a contract to pay £600 for its removal.

Mr. Goodall stated that he had visited St. Annes-on-the-Sea to gather information as to how sand-drifts are dealt with there. At St. Annes the method has been to cover up the sand with tar-macadam and other pavings forming paths, to form alcoves for seats, to form artificial watercourses and lakes, and to plant the remainder of the area with star grass. The star grass planted at St. Annes was similar to the marram used at Rhyl, but stronger in the spike. A very important point was that the public were not allowed to make use in any way of the planted portions. This method has proved entirely satisfactory, and as a general principle Mr. Goodall strongly recommended it for the laying out of the sandhills eastwards of Bath-road to the boundary of Rhyl. He further recommended that the hills should be considerably lowered, and that a lake for model yachting, say about 300 ft. long, 150 ft. wide, and 12 in. deep, should be constructed adjoining Bath-road. The planting season would begin in September, and in order to render permanent the work now being done it should be pushed forward urgently.

The council decided not to entertain the question of laying out the sandhills as ornamental grounds, but they gave instructions that star grass should be planted as soon as practicable along the whole of the sandhills, without any alteration of levels. It was also decided to erect wooden sand screens to arrest the movement of sand in rough weather on the shore westwards from the pier.

The council confirmed an agreement which had been entered into with the firm of contractors who had undertaken the removal of the sand from the East-parade and Marine-drive and other parts of the front for the cancellation of the contract. Owing to difficulties over which they had no control, including the difficulty of getting labour, the firm had applied, under the "war clause" in the contract, to be released, and the council, in committee, consented on terms which were accepted by the contractors, Messrs. Bomford & Evershed.

Mr. J. H. Ellis stated that the Marine-drive and the East-parade had been practically cleared, and that about 10,000 tons of sand had been removed, at a cost to the council very much less than it would have been by the former method of removal by means of shovels and carts. Mr. Ellis said that one of the causes of delay in the carrying on of the work was that sand got into the bearings of the engines. The labour difficulty arose because the firm had obtained exemption for their men on the ground that they would be engaged in steam ploughing agricultural land, and that ploughing the sand as they were doing at Rhyl could not be regarded as a work of national importance.

In their letter to the council the firm said they much regretted the circumstances which had compelled them to relinquish the work, and they trusted that after the war if the council had other work to offer them they would find themselves in a more favourable position for carrying it out.

De-Tinning Company's Meeting.—Municipal engineers who, in addition to those whose names were given in our issues of the 11th and 18th inst., purpose attending the meeting in London next month arranged by the British De-Tinning Company, include: Messrs. Frank Harris (Tonbridge Rural), J. R. Treadwell (Easthampstead), George Riley (Wellington, Shropshire), W. A. H. Clarry (Sutton Coldfield), H. T. Mather (Surbiton), G. W. Holmes (Walthamstow), W. Osborne Thorp (Malvern), W. E. Ryder (Bushey), R. C. Moon (Nuneaton), W. A. Clegg (Dorking), R. H. Crummack (Dover), F. J. Voisey (Dartmouth), W. H. Grieves (Sutton, Surrey), and W. Farrington (Woodford Green). Torquay, while it may not be represented at the meeting, has expressed a wish to co-operate in the company's scheme.

Irvine and District Waterworks.

FERRO-CONCRETE IN NEW FILTRATION PLANT.

During the past ten years the consumption of water for industrial purposes in the area served by the Irvine and District Water Board, Ayrshire, has greatly increased, and at the outbreak of war a large additional supply became urgently necessary. The corporation of Paisley undertook to provide a supply during the emergency, and a line of pipes was laid from the Camphill reservoir of the corporation to the Munnoch reservoir of the Water Board. A large new main has also been laid by the board from the Munnoch reservoir to the filtering station, the cost being £19,000. An increase in the filtering plant also became necessary, and the board, after an exhaustive inquiry into the different methods of filtration, decided on the installation of the Paterson rapid filtration plant, which was inaugurated on June 28th last at the Greenhead filter station. The works recently constructed have altogether cost about £60,000, bringing the total capital expenditure on works to £275,000 in round figures.

Parliamentary powers have been obtained for a large reservoir on the Drum Burn, which is a tributary of the Caaf stream. The head waters of the main stream are to be conveyed into this proposed reservoir by a tunnel through the intervening hill. The capacity of this reservoir will be 420,000,000 gallons, and the estimated cost is £70,000. This new reservoir when completed will fully develop the Caaf gathering area, and will raise the total storage to 811,500,000 gallons.

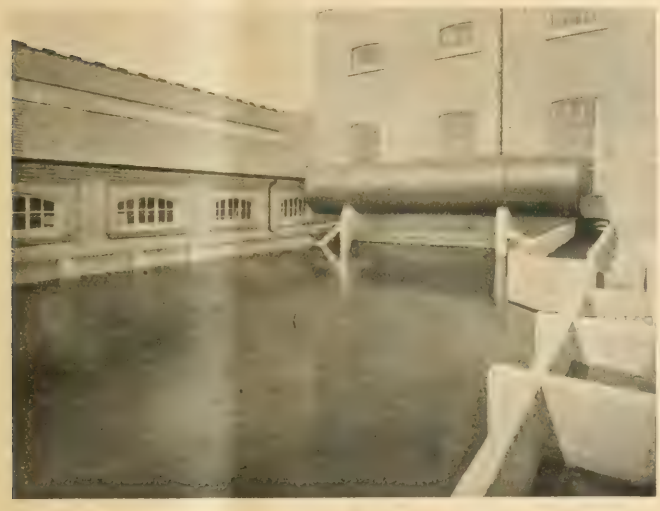

Fig. 1.—Precipitation Tank and Air Receiver, Irvine and District Waterworks.

The population at present supplied from the works is about 35,000, and the average daily consumption, including provision for industrial, sanitary, and all purposes other than domestic, is about 4,500,000 gallons.

The rental of the compulsory areas is £132,887, and the overhead domestic rate is 11½d. The trade rate is 5d. within and 8½d. outside the compulsory areas, subject to certain discounts to large consumers.

FILTRATION PLANT.

The new rapid filtration plant of 5,500,000 gallons daily capacity is housed in a brick building 136 ft. long by 38 ft. wide, placed alongside the existing slow sand filters. At the back of the filter-house is a tower which contains the gear for the preparation and supply of the reagents used for the purification process, and supports the wash-water tank at a height of 36 ft. above floor level. Situate on either side of the tower are the sedimentation tanks, each of 150,000 gallons capacity. The chemical reagents are stored in an annexe to the central tower. The tanks and various auxiliary structures in connection with them were constructed in Mouchel-Hennebique ferro-concrete, in accordance with working drawings prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster.

Fig. 1 is a view showing one of the precipitation tanks, at one end of which is a compressed-air reservoir carried on ferro-concrete supports. The tank in question forms one of the group represented in Fig. 2. Sections and details of the tanks are given in Figs. 3 to 9.

Each sedimentation tank measures 52 ft. 2 in. long by 35 ft. wide by 15 ft. 6 in. deep inside, between the two tanks being the tower mentioned above. Figs. 3 to 4 illustrate the arrangement of the mixing trough and distribution channels along the upper side of the sedimentation tanks, as shown also in the photograph reproduced as Fig. 1.

The two series of five tanks in Fig. 2 below the sedimentation tanks are those containing the Paterson filter-beds. Each range of filter tanks is 63 ft. long by 25 ft. wide by 9 ft. 6 in. deep inside. A section through the sedimentation and filter tanks is given as Fig. 5.

Fig. 6 is a section through one range of filter tanks.

At the right-hand of this drawing may be seen the mixing trough and distribution channels along the two sides of the sedimentation tanks. Some interesting structural details of these will be found in Figs. 7 and 8. The former represents one of the counterforts through which passes the distribution channel, the part-section of a counterfort at the right-hand showing the manner in which the mixing trough is carried. The latter is a section through the same channel between two of the counterforts.

Fig. 9 is a section illustrating the construction of the supports for one of the compressed-air receivers.

The supply is a soft moorland water, containing varying proportions of organic matter in suspension, and having a brown peaty stain. Treatment with a coagulant is essential before the stain can be removed and a colourless supply obtained; and as the water is soft a trace of lime is added to restore the small initial temporary hardness and correct any plumbo-solvent tendency.

The 24-in. supply main entering through the north wall of the tower is coupled to a Francis type turbine situate on the first floor of the tower, which gives ample power for operating the auxiliary gear for the supply of wash water and compressed air, and for the preparation and distribution of the reagent solutions for the purification process. The turbine discharge, after passage through baffles to remove the surge, enters the measuring tank and overflows a 4-ft. rectangular weir, a Fluxograph giving a direct reading in gallons per minute of the amount passing, and a continuous record on a twenty-four-hour chart. A control float resting on the surface of the water in this weir chamber regulates the discharge of the coagulant (alumina sulphate) in direct ration to the amount of water passing, and its thorough mixture is secured in the passage of the water over the weir and through the mixing tanks (see Fig. 10). The water is then distributed to sedimentation tanks arranged on the right and left hand sides of the tower. These tanks are of sufficient capacity to allow over one hour for the completion of the reaction and the precipita-

tion of the heavier impurities before the water passes on to the filters.

The alumina solution is prepared in two 3-in. timber dissolving tanks, and afterwards discharged by an acid-resisting centrifugal pump into duplicate ferro-concrete storage tanks, each of 3,000 gallons capacity. To ensure uniform density of the alumina solution, arrangements are made for effective circulation of the contents of these tanks.

Three ferro-concrete lime-slaking pits are provided in the annexe. The slaked lime is formed into a smooth paste in the primary lime preparing tank, and the contents discharged to the secondary mill alongside the measuring gear. The supply of lime is controlled in a similar manner to the alumina solution, and arrangements are made for its addition either before or after filtration. Fig. 11 illustrates the lime pits and apparatus for its preparation.

There are ten open gravity filter units, each 24 ft. by 12 ft., with a total filtering area of 2,880 sq. ft. The filtering medium employed is a fine grade of specially sifted quartz sand, supported on a bed of pea gravel, and below this the manifold strainer system is arranged, with copper collecting tubes and bronze strainers. The filtered water discharges through the automatic outlet controllers into inspection boxes lined with white enamelled tiles, and overflows into the pure water channel, similarly lined, so that the colour of the effluent can be observed at all times.

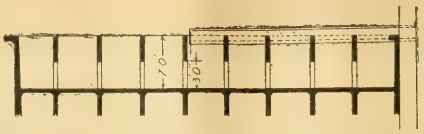

Fig. 3.—Part Longitudinal Section of Sedimentation Tank showing Mixing Trough and Distribution Channels.

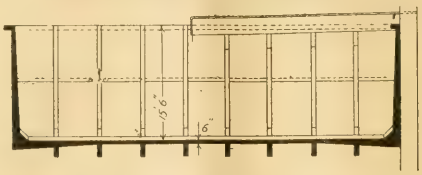

Fig. 4.—Longitudinal Section of Sedimentation Tank showing Exterior of Mixing Trough and Distribution Channels.

Irvine and District Waterworks.

The filter-bed is cleansed by first thoroughly agitating for two minutes with sterilised compressed air at a pressure of about 5 lb. per square inch; then a reverse current of cleansing water floats the loosened impurities into the central waste gutter, and thence to the drain. In this way each filter is thoroughly cleansed and restarted to work in a few minutes, but the controller may be so adjusted that the filter does not discharge purified water until ten or fifteen minutes later. This interval affords an opportunity for filming, and ensures a filtrate of the highest degree of purity.

All the valves and fittings are so arranged that the entire filtering and washing operations are controlled from the front gallery.

The filtered water for washing purposes is raised by a centrifugal pump into the filtered water storage tank of 30,000 gallons capacity, carried on the top floor of the central tower. The compressed air is drawn through a reducing valve from two air storage reservoirs, 6 ft. diameter by 30 ft. long, supported over the precipitation tanks. The wash-water pumps and air compressors are arranged in duplicate, and a 28-h.p. oil engine is installed as a stand-by in case of breakdown of the turbine. Fig. 12 is a view of the filters from the upper platform.

In response to urgent demands, the contractors undertook to give a supply of 3,000,000 gallons of filtered water per day within six weeks after the foundations were completed ready for them to commence. This necessitated their laying down temporary pumping and power plant outside the filter-house, making special water and drain connections to the plant, and the use of an extra rich concrete mixture to ensure very rapid setting of the tankwork. The work was completed and the supply available within the stipulated time.

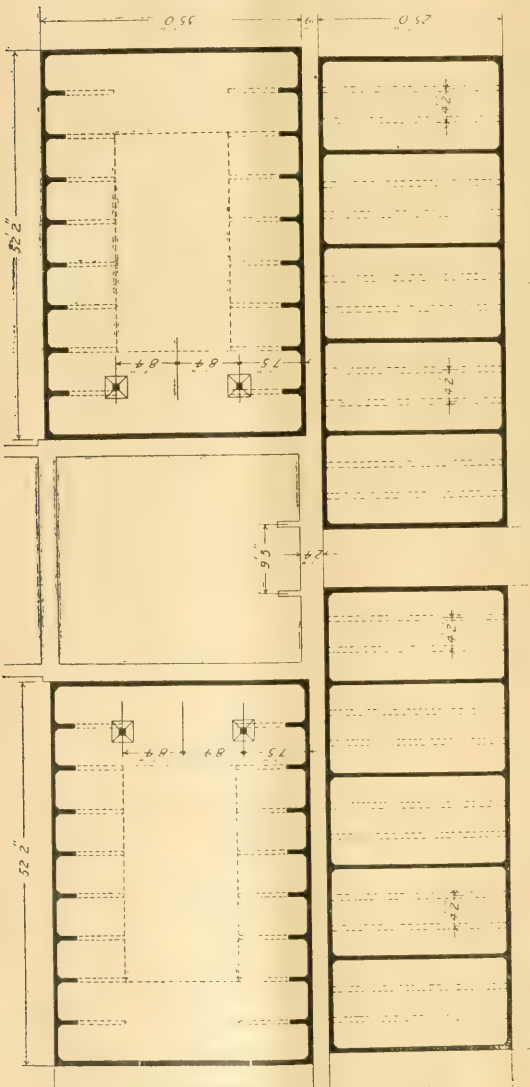

Fig. 2.—Plan of Mouchel-Hennebique Ferro-Concrete Tanks, Greenhead Filter Station, Irvine and District Waterworks.

A Glossary of Road Terms (By H. Percy Boulnois. M.Inst.C.E., St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s.) —Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he has made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

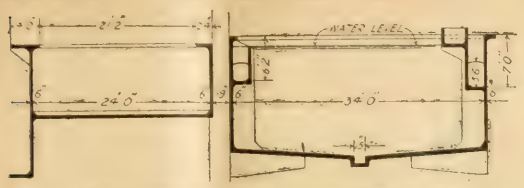

Fig. 5.—Cross Section of Sedimentation and Filter Tanks.

Fig. 6.—Longitudinal Section of One Range of Filter Tanks.

Irvine and District Waterworks.

EAST SUFFOLK ROADS.

LACK OF MATERIALS, LABOUR AND TRANSPORT.

In his annual report, Mr. W. Jervis, county road surveyor of East Suffolk, states that the total expenditure on the main roads maintained directly by the county council, excluding salaries and travelling expenses, amounted during the year ended March 31st last to £31,867, equal to £100·57 per mile.

Mr. Jervis mentions that the abnormal weather conditions, particularly the heavy rainfall in February and the heavy snowfall in March, seriously affected the main roads. Tenders were invited, and the quotations received were subject to stipulations having regard to the conditions obtaining. It had been quite impossible to obtain supplies, owing to the heavy demands of the War Office and the shortage of labour, and, in fact, deliveries from many sources of supply absolutely failed. The price of material increased, and a greatly reduced quantity could only be obtained under the circumstances. The shortage of materials, labour, &c., necessitated the curtailment of improvement work, with the result that judicious and substantial patching had to be resorted to in order to save the roads from serious deterioration. The greatest number of men employed in one fortnight was 147, and the least number 96, while the average staff numbered 125. These numbers showed a reduction when compared with the previous year, owing to the enlistment of several of the men, and the drafting of others on to work in connection with the construction and improvement of roads for the military authorities. The staff would be still further reduced by the calling up of men eligible for military service.

SURFACE TARRING.

The treatment of the main roads with tar was continued and extended to sections recently surfaced. Apart from the advantage of the treatment on hygienic grounds, and as a preservative, it is also observed, Mr. Jervis points out, that snow disappears more quickly from a tarred road surface than from an ordinary surface. An area of 1,048,513 sq. yds. was treated during the year, at a cost of £5,769.

HEAVY MOTOR TRAFFIC.

Attention is called by the county surveyor to the increasing burden on the ratepayers by the extensive use of the roads of the county by heavy motor wagons. "The tendency is," he says, "for this class of traffic further to increase under present war conditions, as, the railway company being in an unfavourable position to carry merchandise, goods are being delivered by road. The military authorities have also in daily use heavy motor vehicles for transport of supplies, &c., throughout the county for the daily requirements of the troops. The Local Government Board Departmental Committee on Road Locomotives and Heavy Motor Cars has only heard part of the evidence to be submitted to it, and its report will no doubt be postponed under the present circumstances. It was anticipated, when the Road Board reconstruction scheme, 1912-16, was embarked upon, that it would have been completed by the end of the financial year 1915-16, and under normal conditions the work would have been finished within the estimated period. For obvious reasons, however, the progress has been unavoidably slow since the outbreak of war, and the scheme is still incomplete; but, notwithstanding difficulties in the Lowestoft and Eye districts of the county, the work is well advanced and nearing completion. The great increase in the volume of heavy traffic now using the main roads supports the contention that the reconstruction scheme was a very wise policy to adopt, as it is not too much to say that the main trunk roads would have been unable to sustain the present heavy traffic if several miles had not been strengthened, as provided for in the reconstruction scheme."

Concluding his report, Mr. Jervis says the utmost difficulty has been experienced in obtaining materials, labour and transport, and in consequence the estimate has been underspent to the extent of £10,736. The shortage of materials has curtailed the reinstate-

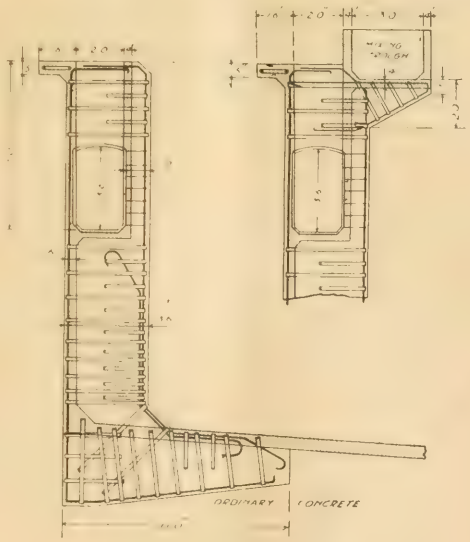

Fig. 7.

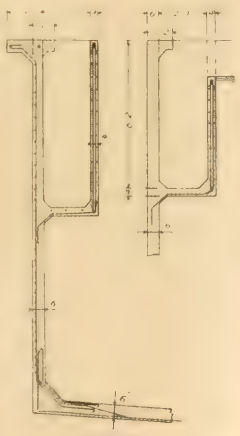

Fig. 8.

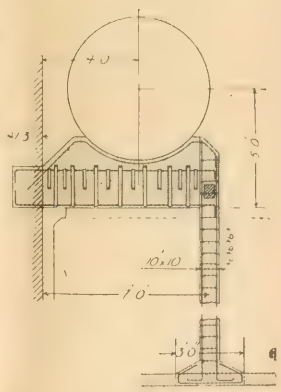

Fig. 9.

Details of Distribution Channel, Mixing Trough and Support for Compressed Air Receiver, Irvine and District Waterworks.

ment of the ordinary wear and tear, and has prejudiced the condition of the main roads. The very heavy traffic and extensive use of the main roads by the military, together with most unfavourable weather conditions, have caused deterioration of the main roads. Several sections of main trunk roads were, fortunately, completed under the reconstruction scheme before the outbreak of war, and are giving good results, notwithstanding the strain of military traffic. The cost of reinstatement has greatly increased, and the enforced retrenchment in the main road expenditure will mean a heavy expenditure after the war, as work will be greatly in arrear, and the roads will have to be strengthened considerably to carry the increased heavy traffic.

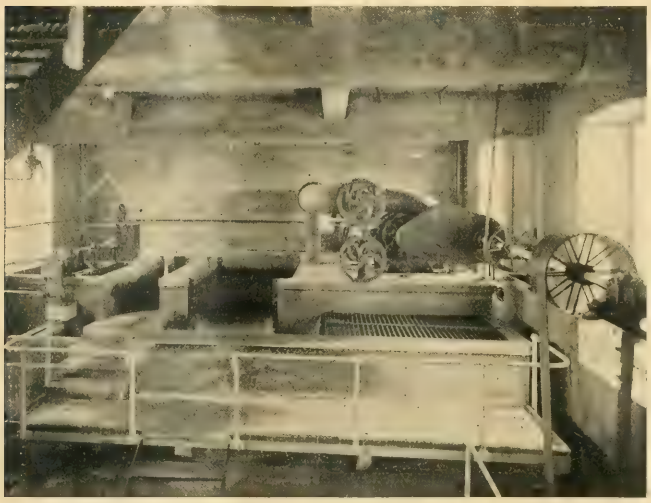

Fig. 10.—Weir Chamber, Turbine and Reagent Supply Gear, Irvine and District Waterworks.

Linking Up of Electricity Supplies.—The recent letter of the Board of Trade requesting electric supply authorities to link up as much as possible in order to conserve coal supplies has been followed by action. A committee has been formed to deal with the many undertakings in Lancashire and Cheshire, and a similar committee has now been formed in London, consisting of representatives of all the London borough councils, fifteen companies, and eight municipalities outside the London area, with the object of co-ordinating the existing supply

Jointing of Drain Pipes.—Now that the prices of building materials are higher than they have been for many years past, a few words on one method of economising will no doubt be welcomed by our readers. It has been customary to use neat cement for jointing drain pipes, whereas if Pudloed cement and sand are used a saving of about 14s. to 15s. for each ton of cement used is effected. We learn that this latter method was adopted on Lord Dunraven's sewerage scheme in County Kerry, and on several other sewage schemes. The makers of Pudlo will be pleased to send particulars of this economical and much safer method of making sanitary pipe joints to any interested readers.

JOHANNESBURG SANITARY SERVICES.

In Johannesburg house refuse is removed in petrol-driven motor lorries and two-wheeled open tipping carts. At each of the upper corners of each cart is fixed a ring, and for each cart a waterproof tarpaulin is supplied, which is secured to the rings. The medical officer of health, Dr. Charles Porter, has more than once suggested the provision of dust-carts with flap covers, to prevent the blowing about of rubbish, but the manager of the scavenging department, after considering various types of covered dust-cart, prefers the tarpaulin arrangement, as it admits of the cart taking a larger load, and saves the considerable weight of a wooden cover. An average of 762 Scotch cartloads per day of house refuse was collected in the twelve months ended June 30, 1915; some of it was burnt at the destructors and some deposited at tips.

As regards the disposal of nightsoil, Dr. Porter in his annual report states that the average number of pails removed per night was 17,230. Every pail, before being sent out, is washed, tested for leakage, dipped in boiling creosote in steam-jacketed pans, and, after the surplus creosote has dripped off in such a way that it is collected and available for use again, is "nested" with other pails and placed in the carts for distribution.

Street sweeping is done in the night-time, except during the wet season, when it is postponed to the early morning, so as to get the mud off the streets just before the day's traffic commences. An average of 10,643 mule loads were removed by 101 Scotch carts each month. The expenditure under this head for 1914-15 was £22,633, but, subject to financial considerations, this service might, in Dr. Porter's view, with great advantage be considerably increased.

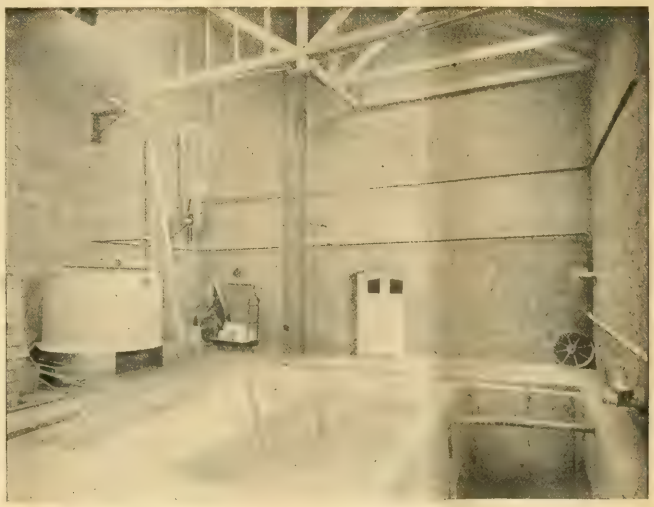

Fig. 11.—Lime-slaking Pits, Mill and Hoist for Reagents, Irvine and District Waterworks.

OFFICIAL REPORTS.

The Editor invites readers to forward regularly copies of annual and other reports, for notice in the columns of "The Surveyor."

SOME RECENT PUBLICATIONS.*

The Mechanical Handling and Storing of Material. By G. F. Limmer, assoc.m.inst.c.e. Price 42s. nett. London: Crosby Lockwood & Son.

That part of the present work which deals with the subject of handling, although based on the author's monograph (now out of print) on "The Mechanical Handling of Material," has been thoroughly revised and brought up to date by the addition of several entirely new chapters. In making the revision, it was found that the storing or stocking, and, conversely, the reclaiming of material (a subject which was formerly treated as of secondary consideration) are now so much bound up with mechanical handling that it would be undesirable, if not impossible, to keep the two subjects apart. Hence the present comprehensive volume, which may fairly claim to contain all the available information on this most important matter. As is pointed out in the introductory chapter, the application of machinery both to the handling and conveying of heavy and bulky material has of late years assumed a paramount interest. No branch of engineering has so rapidly developed in modern times as the construction of appliances for conveying, loading, and unloading heavy goods, more particularly coal and ore. In the case of grain and seeds, again, the construction of granaries and silo-houses on a large scale has been undertaken, and the aid of automatic machinery more or less sought to provide means of handling this material without the assistance of hand labour. It is therefore eminently necessary that engineers should more than ever devote their attention to economies that may be effected by mechanical handling and storage. Mr. Limmer's work is comprehensive in character, its main divisions being (1) continuous handling of material; (2) continuous handling of material by pneumatic and hydraulic means; (3) intermittent handling of material; (4) unloading and loading appliances; (5) miscellaneous installations; and (6) the automatic weighing of material. The volume contains 744 quarto pages on art paper, and is profusely illustrated and well indexed. It is well-nigh indispensable to those who are concerned with the handling of material on a large scale.

Fig. 12.—Filters from Upper Platform, Irvine and District Waterworks.

Machine Design. By A. W. Smith and G. H. Marx. (4th edition.) Price 12s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

In the preface to this book the authors point out that the whole subject of machine design cannot be treated exhaustively in a text-book of ordinary dimensions, owing to the almost infinite variety of machines in existence. The object of the work therefore is simply to state the principles that underlie all machine design, and to suggest methods of reasoning which may be helpful in the designing of any machine. The five considerations of primary importance are stated to be adaptation, strength and stiffness, economy, appearance, and safety, and these principles are kept well in view throughout. The fourth of these principles is stated in language which might have been used by Ruskin himself: "There is a *beauty* possible of attainment in the design of machines which is always the outgrowth of a *purpose*. Otherwise expressed, a machine to be *beautiful* must be *purposeful*." The authors have done their work thoroughly and well, and this new edition, like its predecessors, may be recommended with confidence to students, who should, however, possess a fair knowledge of pure and applied mathematics before reading it.

The Operation of Sewage Disposal Plants. A manual for the practical management of sewage disposal works, with suggestions as to improvements in design and construction. By Francis E. Daniels, director of water and sewerage inspection, Board of Health of the State of New Jersey. Price $1·50. Published by *Municipal Journal*, New York, U.S.A.

Although published for the use of sanitary engineers and sewage works managers in the United States, and dealing with some methods of treatment which are little known in this country, this book contains much information and many suggestions which should be of interest and value to those who have charge of sewage works here or who have to design sewage disposal works. The chapter dealing with grit-chambers and screens is very interesting in many ways, but particularly in the descriptions it gives of the various methods of screening and kinds of screens which have been tried from time to time. Again, in describing the various systems of preliminary treatment in tanks, there is much valuable information deserving careful study. The sewage works manager who is a chemist will be interested in the chapters on testing stations, and on making physical, chemical and bacterial tests; and the engineer in the treatment adopted for securing the greatest possible digestion of sludge, and for its final disposal. Above all, it is obvious from the text that the author is a thoroughly practical man, and that the information he gives and the suggestions he makes are based entirely upon his own personal experience. We can strongly recommend this book to all who are interested in sewage disposal.

Water Supply in the St. Thomas Rural District.—A new water supply for Topsham, in the rural district of St. Thomas, Devon, was inaugurated recently. The well and pumping station of the new supply are situated between Newcourt and the main Exeter road. The well, which is 61 ft. deep, and has a diameter of 8 ft., is lined in order to keep out surface water, the new supply being obtained from the red sandstone. From the bottom of the well extends a borehole, which goes down another 130 ft., giving a total depth of 191 ft. An average continuous yield of 120,000 gallons per twenty-four hours without exhausting the borehole was obtained during a fourteen day and night trial made before the well was constructed. The water is lifted by three-throw pumps (Beck & Co., London), driven by oil engines (Ruston, Proctor & Co., Lincoln) to a water tower about three-quarters of a mile away. The works were designed and superintended by Mr. Sidney R. Lowcock, M.Inst.C.E., M.I.Mech.E., Westminster.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

Road Direction Signs.*

By C. H. COOPER, M.Inst.C.E., Borough Engineer, Wimbledon.

Highway traffic forms such a part of a nation's economy that every means tending to reduce the cost of haulage deserves careful study.

Direction signs were desirable in the past; with the introduction of mechanical haulage, signs, such as can be read without stopping, have become a necessity.

Take for instance the driver of a van distributing goods from a store. With animal traction, his journey from home could not exceed 12 miles, so that the area he could traverse might be taken at 450 square miles. With mechanical haulage this driver could take journeys of 80 miles over some 20,000 square miles of country. This man might have a fair idea of the smaller area, but he could have no useful knowledge of the greater. With animal traction he could obtain information relating to the shorter journey from those he met on the road and at the inns, where he and his horse receive refreshment.

Fig. 1.—Information that Appears on a Semaphore Arm or Plan of Road.

Such means of information is useless for the journeys he now takes. A system of direction signs must therefore be devised to enable him to determine his route without stopping or materially reducing his speed. Such a system would effect an economy in the time of transit that would several times pay the cost it would involve.

It may be argued that drivers should consult maps, but map-reading is an art difficult to acquire and beset by many pitfalls to the best readers. To the majority of drivers maps give information as to the routes to be taken, but without direction signs such drivers would be unable to follow their route.

The information given by the writer's signs relative to each road consists of a top line giving the principal town to which the road leads, and its distance, while the bottom line gives the nearest town or village and its distance. No other writing appears (see Fig. 1). It is of importance that the information should be given in a standardised form, so that the driver knows what to expect when he reads a direction arm.

If necessity ever was the mother of invention, then a certain junction of cross-roads in Kilcowanmore, Co. Wexford, is the father of the writer's signs, as illustrated in the Christmas Number of the *Car*, 1913. For months after the writer's limbs bore evidence that the crossing was difficult for those unacquainted with its intricacies. Had the writer observed a semaphore plan on the approach to such crossing, he and his cycle would have been saved the injuries they sustained, and the night have been spent in more genial surroundings than a neighbouring inn.

It may be well to consider what railway practice has adopted to caution drivers before negotiating a crossing—namely, a distant signal placed at a distance from the crossing proportionate to the speed allowed, and a home signal near the crossing, thereby giving the driver two cautions before the crossing is reached.

It might in certain cases be well on a highway to adopt a distant signal in order to attract a driver's attention, but the multiplication of signs is not desirable. The writer points to the fact that on a railway a driver receives his caution before reaching a crossing, whereas on a highway, a driver is allowed to reach a crossing, where he runs the risk of colliding with approaching vehicles, and is at the same time expected (1) to find which direction arm refers to his route, and (2) to read the directions thereon. To do this a driver has to slow down, and in many cases actually stop.

The writer contends that a driver should know the nature of the crossing he has to negotiate, and the road that leads to his destination, before he reaches such crossing, so that he may concentrate his attention on the avoidance of approaching traffic, which in most cases does not come under his observation until the crossing is reached.

The writer proposes to supply the information either by means of (*a*) a semaphore plan, or (*b*) an actual plan. When semaphore plans are adopted, a plan of the crossing, as seen by traffic approaching, is placed in each road leading to the crossing at a distance of 100 ft. therefrom. The sole object of the sign is to give, in the simplest form, the necessary information to onward traffic. With 3-in. letters on an arm the sign can be read at a distance of 200 ft.—*i.e.*, 300 ft. from the crossing. Travelling at 20 miles per hour, a driver would have 7 seconds in which to read the sign, and 3 seconds after passing the post to consider before reaching the crossing, 10 seconds in all, which seems ample if we consider that only 15 seconds is allowed on tube railways for stopping to discharge and take up passengers.

A semaphore plan is said to attract attention better than an ordinary plan, and may be simpler for the uninitiated to read, but, if generally adopted, complete plan signs would soon be understood.

When a single lantern can be seen from all roads approaching a crossing, the writer suggests that a lantern be so placed that a face is opposite each road, and on each of these faces is depicted a plan

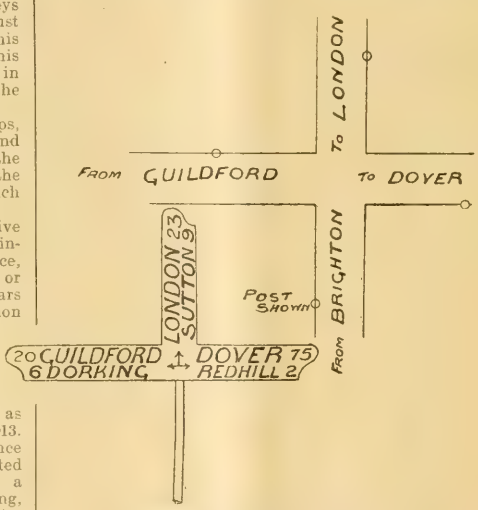

Fig. 2.—Semaphore Signs Applied to Four Cross Roads.

of the crossing as seen from the particular road it is opposite. The writing on these plans allows of its being read at a distance of about 240 ft.

A complete plan has many advantages over a semaphore plan, as it shows bridges and obstructions to the view, such as houses, &c., which assist a driver in avoiding accidents.

The writer considers that whatever system of signs may be adopted it should be applied as universally as possible. Great Britain should have but one system. When life depends on the reading of a sign, drivers should not be confused by having to read more than one system. In his paper he makes no reference to other systems, preferring that each author should describe his own system.

The writer claims that his system acquaints a driver with what he has to negotiate before the negotiations take place, which is essential in order

* From a paper submitted at the recent annual meeting of the Institution of Municipal and County Engineers at Blackpool.

to avoid accidents. He also claims that he supplies the necessary information in the simplest form possible.

THE PROPOSED RESTRICTIONS UPON TRACTION ENGINES.

A SUFFOLK PROTEST.

The Highways Committee of the West Suffolk County Council recently invited the opinion of the council upon a resolution from the Suffolk Farmers' Union, which body protested against the proposed restrictions upon traction engines put forward by the County Councils Association.

Mr W. Bigg moved that the council should adopt the resolution, which was that the prohibition of bands on the front wheels and crossbars on the hind wheels would, if carried into effect, render the traction engine practically useless for agricultural purposes.

Mr. E. J. Rolph said the local branch of the Farmers' Union was unanimous on the matter.

Asked by Mr. Lake if the iron bands did very much harm to the road, the county surveyor, Mr. W. L. Jenkins, said the county surveyors around London supported the idea, but surveyors as a whole realised it would be impossible to do away with the bands.

Mr. W. R. Hustler said he did not think the agricultural traction engine did any harm to the main county roads, though it might to the bad rural roads. A heavy traction engine carting three tons of bricks, however, did a great deal of harm to an ordinary road.

Mr. G. Townsend said he defied any man to steer an engine without bands on the front wheels. They would do more harm to roads without the bands than with them.

The resolution was adopted.

BUILDING PROGRESS IN SHANGHAI.

It is interesting to note that, however great the slump in the building trade may have been in Great Britain since the war commenced, the local contractors in Shanghai have no cause for complaint, as, despite the enormous increase in the price of nearly all building materials, the boom which commenced in 1915 still continues, plans having been approved for no fewer than 6,829 structures of an estimated value of £622,816 during 1915 and 1,584 structures of an estimated value of £485,447 during the first six months of the current year.

Contrary to expectations, the buildings now being erected are of a more permanent nature than has hitherto been the case, particularly where they front a principal thoroughfare.

It would seem that, despite the large number of Chinese dwelling-houses and other buildings which are being and have been erected of late years, the supply is still below the demand, which is not surprising when one takes into consideration the fact that the population has grown from 501,541 in 1910 to 638,920 at the end of 1915 an increase of 137,379.

The building inspection staff has a peculiarly difficult task to perform, owing to the local artisan being relatively inexperienced. The amount of inspection necessary will the more readily be understood from the fact that during the last few years a monthly average of 250 blocks of buildings under construction in different parts of the Settlement has been maintained.

For some time past it has been felt that the existing building rules are inadequate, and a new set more in line with modern requirements is being drawn up by a local commission appointed by the municipal council.

Apart from buildings erected under permits issued by the municipal council, municipal buildings, such as new central offices, hospital, fire stations, schools, &c., to the value of £202,625 are at present in course of construction.

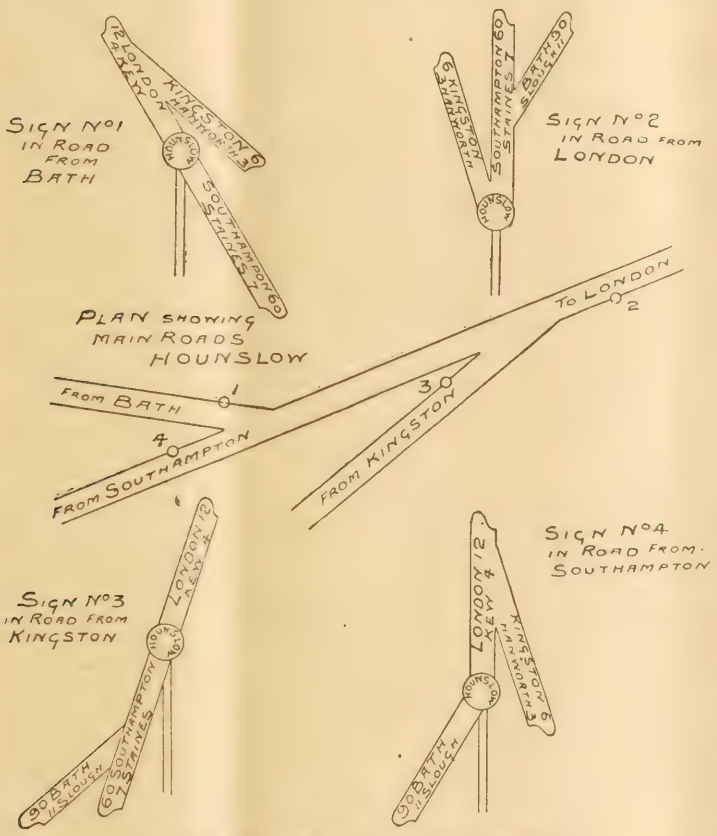
SIGN No1 IN ROAD FROM BATH
SIGN No2 IN ROAD FROM LONDON
PLAN SHOWING MAIN ROADS HOUNSLOW
FROM BATH
FROM SOUTHAMPTON
FROM KINGSTON
TO LONDON
SIGN No3 IN ROAD FROM KINGSTON
SIGN No4 IN ROAD FROM SOUTHAMPTON

Fig. 3.—Semaphore Signs Applied to Hounslow.

Glasgow Cleansing Department.—On the occasion of a recent inspection reference was made to the satisfactory results obtained from the estates under the control of the Glasgow Corporation Cleansing Department. Bailie Robert Mitchell spoke of the success of the cropping on the estates, which had been improved by the depositing of the city refuse, and mentioned that for last year there was a profit of nearly £3,000 on the cropping account of Ryding and Robroyston estates. The year's hay crop, he said, was exceedingly good, and they had also oats, wheat, barley, turnips, and potatoes. In connection with the collection of waste paper, they had the assistance of the Women's Volunteer Reserve. For the paper they now received 65s. per ton, as against 4s. at the time that the department first took up the work.

HIGHWAY MAINTENANCE IN THE BELPER RURAL DISTRICT.

The maintenance of the 162 miles of highways in the Belper rural district during the year ended March 31st last cost, after making certain deductions, £4,673, or £29 4s. 1½d. per mile.

The estimated cost of maintenance for the year was £5,350, the actual expenditure thus, Mr. Robert C. Cordon, the engineer and surveyor, points out in his annual report, showing a saving of £677.

STEAM ROLLING.

During the period covered by the report the council's steam roller consolidated 5,300 tons of stone over an area equal to 61,000 super. yds. of roadway, approximating to 1 ton to every 11½ yds. of road, and an average of nearly 27 tons of stone rolled daily.

Below is an analysis of the days worked by the roller:—

	Days.
Actual working days	197
Washing out boiler	24
Under repairs	21
Travelling over district	14
Standing for frost, &c.	52
Holidays	6
Sundays	52
	366

The expenses with the roller were:—

		Rate in pence per ton consolidated.
Engine driver's wages ...	£88 ...	3·98
Sweeper's wages	52 ...	2·35
Lad attendant	16 ...	0·70
Carting bind, water, &c. ...	112 ...	5·07
Coal	16 ...	0·70
Oil, waste, &c.	7 ...	0·31
	£291	13·11

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

Cape Town Main Drainage.—The corporation of Cape Town are inviting tenders for the carrying out of contract No. 1 (main sewage pumping station), in connection with the main drainage of the southern suburbs of that city, as follows: Section No. 1, pumps, motors, switch gear, cables, &c.; section No. 2, cast-iron pipes and sluice valves, &c.; section No. 3, penstock gates and screens; section No. 4, overhead travelling cranes; section No. 5, tipping wagons and rails; section No. 6, fitter's expenses and contingencies. General conditions, specifications, drawings, forms of tender, &c., can be obtained from Messrs. Davis & Soper, 54 St. Mary-axe, London, E.C., the agents of the corporation, and tenders must be delivered not later than September 18th next.

Drying and Conservation of Timber by Electricity.—*Indian Engineering* reproduces from a Swiss building trade journal some interesting particulars of a method of drying and conserving timber by means of treatment by electric current which is being tried on the Continent with success. It appears that the effect of passing a strong electric current through freshly cut timber causes a chemical change producing rapid oxidation of certain parts, combined with a physical change in the cellulose and its numerous derivatives, which renders them better able to withstand the action of fungi, while increasing its suitability for mechanical use. It also confers an aseptic quality to the sap elements remaining in the timber. The "Nodon" process, as it is called, is claimed to be so effective that in a few hours a thorough oxidation of the wood-sap takes place, a process which, in free air, would require several months; the process reduces the hygroscopic tendency of the wood so that it no longer readily absorbs moisture. The process can be applied to green timber with such success that in a few weeks a thorough seasoning takes place. A certain amount of moisture helps to carry the electric current through the timber, so that the process is best applied to timber in a not too dry condition—in fact, as soon as practicable after felling. It can be applied in the forests where the felling takes place, thus reducing transit weight. The electrical energy required is 3 kw. to 6 kw. per cubic metre.

ROAD UPKEEP IN BIRMINGHAM.

COST OF TAR-SPRAYING.

In the period covered by the last issued annual report of Mr. H. E. Stilgoe, the city engineer, the total area of macadam surfaces tar-sprayed in Birmingham was 2,426,029 super. yds.; the area sprayed a second and third time was 135,224 super. yds., making an area of street equal to 2,290,805 super. yds., comparable with a length of 177¾ miles.

The cost of the work was £10,126, being at the rate of 1·001d. per super. yard. In the previous year the rate was ·911d.

The application of tar to the macadamised street surfaces has effected a saving in repairs, maintenance and scavenging, and is continuing to give satisfaction.

WOOD PAVEMENT.

An area of 125,487 sq. yds. of wood pavement is under maintenance contract with the Improved Wood Pavement Company. The amount paid during the year for maintenance was £4,398, being at the rate of 8·41d. per square yard, this payment covering according to contract the cost of entire renewals where necessary.

The approximate area of wood pavement maintained directly by the corporation is 203,314 sq. yds., the cost of which during the past year was £2,040, being at the rate of 2·40d. per square yard. This figure refers to repairs and cost of renewals where necessary.

During the winter 31,160 loads of snow were removed at a cost of £5,095—a rate of 3s. 3d. per load.

There are 641½ miles of roads in the city of Birmingham.

ROAD BOARD'S EXPENDITURE.

THE EFFECTS OF THE WAR.

The sixth annual report of the Road Board, which was issued on Wednesday, shows that applications were made during the year ended March 31st last for £310,261, of which £297,038 was for improvement of road crusts. The advances applied for show a decrease of £1,691,003 as compared with the previous year, and of £2,283,544 as compared with 1913-14, the decrease being due to the reduction in the amount of work undertaken by highway authorities in consequence of the war.

In February of this year, following the withdrawal of the Retrenchment Committee's suggestion that grants for road improvement should be entirely suspended, and the arrival at a decision to prevent serious deterioration of roads of real importance, the board circularised county authorities intimating that the aggregate amount of loans or grants for the financial year 1916-17 for this purpose would not exceed £200,000, to be confined mainly to refined-tar treatment.

Besides the construction of new roads and the improvement of private roads for the military authorities, the board have undertaken similar work for the Admiralty and Ministry of Munitions. The estimated cost to June 30th last is £1,809,621.

Examination for Highway Engineers.—An open competitive examination for senior highway engineers—open to all male citizens of the United States who meet the requirements— has been announced by the United States Civil Service Commission. The purpose of the examination is to establish an eligible list from which vacancies will be filled in the office of Public Roads and Rural Engineering, Department of Agriculture. Remuneration is from £400 to £800 per year, candidates obtaining a rating of 85 per cent or over being eligible for appointments to positions carrying salaries of £600 or more. Applicants must be thirty years of age, be physically fit, and must have had not less than four years' preliminary engineering experience, or must be graduates in engineering from a recognised college. Eight years of responsible engineering experience are required, of which five years must have been in highway work. Competitors will be examined on the following subjects, which carry the relative values indicated: Education and preliminary training in engineering, 20 per cent; responsible experience in engineering and fitness, 30 per cent; responsible experience in highway engineering, 50 per cent.

The Surveyor
And Municipal and County Engineer

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CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

MOTOR-'BUSES AND THE ROADS.

To the Editor of The Surveyor.

Sir,—The scale showing the rate of payment per 'bus per mile or 'bus per annum, in your issue of the 18th instant, may be regarded as satisfactory or unsatisfactory, depending upon the point of view. It would be interesting to know what are the bases on which the figures have been arrived at. On the face of it there is a distinct encouragement to continue the use of granite, limestone and other water-bound roads, and the discouragement of specially constructed either wood paved or asphalt roads, which, I note, are given place of honour—*i.e.*, as being the most satisfactory.

Local authorities have power to maintain highways, but there is no stipulation as to how they should maintain them or with what material. If an accident occurs to a vehicle through the condition of the road, it having been very badly worn, the local authority is not liable; so that we may conceive of a local authority spending the £152 received from the 'bus on the roads that it traverses and doing no more. An adjoining local authority may, on the other hand, think that it is in the public interest to put down the specially constructed road at a greatly increased initial cost, and instead of receiving £152, the sum is at once reduced to £57. The £152 may be considered to be the amount per mile that would be received if there were 'buses running either way at the rate of one every twelve minutes. The average cost of the maintenance of main roads in this country is £120 per mile, so that under these circumstances the local authority would be receiving from the 'buses which traverse the roads at the rate of one every twelve minutes 30 per cent more than the average cost of the maintenance of the main roads of this country.

The £57, the ¾d. per 'bus per mile which is put forward as the charge on wood pavements, would be a very nice source of income for the local authorities who have a large number of 'buses passing over the roads.

For example: On the Fulham-road in the Broadway, 1914, the total number of 'buses per annum would be 632,000, the income on a ¾d. basis would amount to £980, whereas the total cost of the pavement, together with the repairs, works out at £598, and the proportion of the 'buses to the other traffic is only 29 per cent.

In another case the cost of the pavement is £437 per annum, and the percentage of motor-'bus traffic is 10 per cent, yet we should have received £360 towards the cost of repairs.

It is quite evident, therefore, that the amount of wear caused by motor-'buses to wood-paved roads is at a much lower rate than ¾d. per mile. It will also be evident that if three 'buses pass a certain point every minute, as they do at the town hall, Fulham, during certain parts of the day, the income that we should receive per mile per road would be £2,052.

I venture to suggest that no engineer can bring forward a road which costs, or would cost, even under such circumstances, as much as £2,052 per mile.—Yours, &c.,

Francis Wood, M.Inst.C.E.,
Borough Engineer and Surveyor, Fulham.

August 22, 1916.

THE SETTING OF CONCRETE.

To the Editor of The Surveyor.

Sir,—In your issue of August 18th I notice, under the heading of "Things One Would Like to Know," a paragraph with reference to concrete. I might say that I was told some years ago that if I allowed the mixed concrete to remain on the banker for an hour or two before it was laid I should have a quicker setting and a better result. This I tried, but the result was not satisfactory. The concrete was laid in a footpath, and a dozen bays which were laid in this manner all became mottled on the top soon after the foot-passengers were allowed over it, whereas the bays adjoining, which had the concrete put in immediately after mixing, kept a very smooth appearance, and were perfectly satisfactory in every way. Of course, I am not going to say that it would be a failure every time after it has been mixed two hours, but the weather conditions are everything; for instance, to mix concrete and leave it on the board for two hours in a broiling sun would, I feel sure, be very detrimental. The best thing is to get it spread as soon as possible, and, if necessary, keep it damp for a considerable period.—Yours, &c.,

W. Matthews Jones,
City Surveyor, Chester.

August 22, 1916.

PREMATURE BURIAL.

To the Editor of The Surveyor.

Sir,—The allusion to cremation in your excellent journal of 11th inst., under "Things One Would Like to Know," reminds one that the existing system of giving death certificates without personal medical verification of the fact of death by means of scientific tests is a very unsatisfactory guarantee against the burial of living, though apparently dead, persons. It is this amazing defect in the law which the Deaths and Burials Bill aims at removing, and not being a party question it will, it is hoped, soon be considered by Parliament and placed on the Statute-book. This will, however, greatly depend upon the amount of material and moral support that is received by the Association for the Prevention of Premature Burial, the promoters of the Bill.—Yours, &c.,

Jas. R. Williamson.

100 Chedington-road,
Upper Edmonton, N.
August 18, 1916.

THE LIMMER AND TRINIDAD LAKE ASPHALT COMPANY, LIMITED.

We are informed that arrangements have been completed for the amalgamation of the Limmer Asphalte Paving Company, Limited, and the Trinidad Lake Asphalt Paving Company, Limited, under the name of the Limmer and Trinidad Lake Asphalt Company, Limited.

The combined company will be responsible for the completion and fulfilment of all work in progress and contract obligations that have been undertaken by either company.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

Stone U.D.C. The council have received copies of the County Council Health Committee's report, in which the county medical officer, Dr. G. Reid, makes reference to certain sanitary defects in the township. Referring to the sanitary staff, the medical officer says: "The sanitary staff consists of an inspector who is also supervising medical foreman, who superintends the general work. In a town of the size of Stone it is quite easy, under present circumstances that the post of surveyor and sanitary inspector should be held by one man, but I must point out that the present officer has no clerk, and a large portion of his time is consequently occupied in correspondence and other routine clerical work, whereas his time ought to be fully occupied with strictly professional work."

BUILDINGS.

Bristol T.C. The Health Committee recommend the Port Sanitary Authority to build a small hospital on a site belonging to the corporation at Chapel Pill.

Okehampton T.C. The council have accepted a tender, at £373, for carrying out improvements to the cattle market. A tender has also been accepted for building a wall round the council's land in George-street.

Oldham T.C. It is proposed to construct an underground convenience in Mill-street.

Ottery U.D.C.—Upon the recommendation of the surveyor, Mr. H. Forster, it has been decided to replace the bridge at Whiphay in steel and concrete at an estimated cost of £180.

West Suffolk C.C. The council have accepted the tenders of Mr. R. J. May of Norwich, at £321 (for foundations) and £151 (for concrete work) in respect of the rebuilding of Waste Water Bridge, Hengrave.

HOUSING AND TOWN PLANNING.

Abersychan U.D.C. The council are again appealing to the Local Government Board to sanction a loan for a housing scheme, urging that accommodation is required by miners and others.

Atherton U.D.C. It is proposed to purchase a site for the purpose of a housing scheme.

Coventry T.C. Of the 100 houses being erected by the corporation at the corner of the city boundary near Stoke Heath, about thirty new houses are ready and the remainder are nearly completed. The rents range from 5s. 6d. to 11s. 6d. a week. It is hoped to continue the houses on the site, and it is possible that the Housing Committee will seek powers to erect this number while the present Act is in force.

Huddersfield T.C. As the result of a visit by a Local Government Board inspector with respect to the scheme for 1,000 houses in the Lockwood district, it is understood that the Housing Committee have been instructed to deal generally with the matter.

Mexborough U.D.C. The Building Committee have been asked to report on the advisability of preparing a housing scheme after the war.

Selby U.D.C. The question of the new houses which have been proposed by the special committee, and which have arisen during the recent enquiry of work, was considered at a special meeting of the council on Wednesday. Sixty-two houses are proposed to be erected, and it was decided to complete the scheme by purchasing a piece of land at Scott Hall Farm, Selby, for the erection of 28 houses. The land is to be purchased at £50 per acre. The site for the remaining houses proposed will be on the Flaxley Road estate, the property belonging to the Rev. Canon Hall. The new scheme was known as [illegible] and provided over 100 houses for the working classes.

MOTOR TRANSPORT.

Coulsdon and Purley U.D.C.—A sub-committee of the Fire Brigade Committee recommend the purchase, at a cost of £600, of a motor chassis to be fitted to a body estimated to cost £70.

Leeds T.C.—A 3 ton motor lorry is to be purchased for the use of the Waterworks Committee.

Millom U.D.C.—The Highways Committee have adopted a recommendation in favour of the purchase of a steam wagon.

Ongar R.D.C. It is proposed to purchase a motor ambulance at a cost of £170.

Southend T.C. The combined Health and Highways and Works Committees have decided to consider the question of traction haulage after the termination of the war.

Stratford-on-Avon R.D.C.—The council are considering the question of purchasing traction wagons.

REFUSE COLLECTION AND DISPOSAL.

Docking R.D.C. The Local Government Board have sanctioned a scheme for the scavenging of Ringstead, and the council have referred a scheme for Heacham to the parochial committee of that district.

Southend T.C.—The town council refused to confirm a proposal of the Economy Committee to reduce the estimate for the removal and disposal of house refuse from £8,750 to £7,750. The medical officer reported upon certain complaints which he had received as to the need for a more frequent collection of house refuse from certain boarding-houses in the borough, and it was resolved that the borough engineer and surveyor, Mr. E. J. Elford, should be authorised to apply to the tribunal for the exemption until the end of the "season" of such men as he may consider to be necessary to carry out this work efficiently.

ROADS AND MATERIALS.

Birmingham T.C.—The corporation have over fifty women engaged as street workers. They are mainly occupied in preparing the road surfaces for tar-spraying, and they are reported to be doing the work satisfactorily. During this summer 131 miles of road have been tar-sprayed, against 121 in the previous summer.

Blean R.D.C. It has been agreed to apply for powers to make up Lancaster-gardens and Osborne-gardens, Reculver, under the Private Streets Works Act, 1892.

Cheadle and Gatley U.D.C.—The surveyor, Mr. F. R. Gibbins, has been instructed to make up the approach road to the sewage disposal works.

Dartford R.D.C.—The Road Board have offered to meet half the cost of surface-tarring a number of roads, conditionally upon necessary repairs being effected.

Docking R.D.C.—It has been agreed that the road-men employed by the council who remain on the roads during the harvest shall be paid at the rate of £1 10s. per week for one month during that period.

Farnham U.D.C.—A scheme has been approved for the widening of Bear-lane, two owners of property having conveyed the necessary land for this purpose.

Hayle U.D.C.—It has been agreed to adopt the proposal of the Road Board that the council should contribute £100 towards the repair, estimated to cost £700, of the road from the viaduct to Hayle Bridge.

Horsham U.D.C.—A letter was received from the Aldershot and District Traction Company, Limited, asking whether the council would favourably consider a proposal to run the company's motor omnibuses into Horsham from Guildford, *viâ* Bramley, Cranleigh, and Rudgwick. The county surveyor, Mr. H. W. Bowen, wrote suggesting that a conference of the highway authorities of West Sussex should be held to deal with the question of new omnibus routes, and the extent of compensation. It was agreed to support the proposed conference, and the chairman and clerk were delegated to attend as delegates.

Kesteven C.C.—The county surveyor, Mr. W. B. Parker, reports that the amount expended on the main roads for the year ending March 31st last was £23,220, which is only to be expected in an expenditure of less than £21,000 in ordinary times, owing to the great increase

in price of materials and rate of wages. It really means that some 60 per cent. of work estimated to be necessary for the year under report had not been carried out and so far as could be seen at present it would be impossible to carry out all the proposed works during the ensuing year. It was useless to disguise the fact that consequently there would be more deterioration than usual, and eventually a somewhat heavy expense would be incurred in overtaking the arrears of work. It would appear, therefore, to be a good policy to accumulate all the unexpended balances to meet the heavy cost of reinstatement later on.

Kiveton Park R.D.C. The council are seeking powers to make up Long Street under the Private Streets Works Act, 1892.

Newmarket U.D.C. The Road Board in a letter to the council, have expressed their pleasure at the entirely satisfactory manner in which the contractor, Mr. W. H. Lay, has carried out the work in connection with the construction of a military camp road in the district, and intimated their desire to grant Mr. Lay a small honorarium.

Newry No. 2 R.D.C. It was reported on Saturday that only one of the five road maintenance proposals which were passed at the quarterly meeting had been tendered for. Eight special works appeared on the sheet, but not one of these was tendered for. It was resolved that the Armagh County Council should be asked to give all the proposals not tendered for into the hands of the county surveyor for execution, with one exception.

Nuneaton T.C.—The Road Board have promised a grant of £300 towards the cost of macadamising the main roads. It is proposed to provide a macadamising plant at an estimated cost of £300, including the erection of a shed.

Phillack U.D.C. An engineer representing the Road Board has estimated that the cost of repairing the road from St. Erny School to Loggans will be £1 800 and the cost of repairing the road from Loggans to the old arsenic works £1 200. The council have decided to consider the question of making a contribution to these and other works when it is placed before them formally by the Road Board.

Plymouth T.C.—The Works Committee are considering a recommendation of the Sanitary Committee to make use of salt water for street watering.

Skipton R.D.C. The council are in communication with the county council with respect to a scheme for improving the county road at Beamsley.

Southend T.C.—The Health Committee have called the attention of the Highways and Works Committee to the necessity for more frequent watering during the season of the many visitors to the borough.

Surrey C.C. It was reported that plans and estimates had been prepared in respect of 265 dangerous corners out at 197

SEWERAGE AND SEWAGE DISPOSAL.

Abingdon T.C. A scheme is under consideration for carrying out sewerage pension at an estimated cost of £1,000, plans of which have been prepared by a commercial firm extending the acreage of the sewage farm.

Adlington U.D.C.—The council have appointed the proposals of the surveyor, Mr. R. Edge, for the improved treatment of the sewage at Fair View Farm.

Clowne R.D.C.—It has been decided to provide bacteria beds in connection with the outfall at Creswell.

Lymington T.C. A special meeting is to be held to consider the sanitary arrangements in May avenue. The medical officer of health, Dr. J. Rendall, having advised that the houses should be connected with the sewer. A report has been received from the Local Government Board respecting the complaints as to nuisance arising from the discharge of sewage at Oxey. The board, it was intimated, had decided that the outlet must be closed and the flushing pipe connected to the main outfall pipe. The town council are in communication with the board as to the best method of procedure to be adopted.

Oswestry R.D.C. A letter has been received from the military authorities stating that they have decided to do away with the necessity of contractors to deal with the sewage from the Park Hall hutments and pumping it out to the contract farm, the council would then cease.

Warmley R.D.C.—Owing to persistent complaints the council have instructed the medical officer to [illegible] at the various outfalls at the [illegible] Bath Corporation [illegible] is prejudicial to health.

WATER, GAS, AND ELECTRICITY.

Chesterfield T.C.—The town council are applying to the Local Government Board for authority to carry out extensions to the electricity works.

Earby U.D.C. It is proposed to provide at an estimated cost of £800 a gas supply for the district and to instal a disposal works.

Horsham R.D.C.—A proposal is being considered for the purchase of the South Sussex Gas and Water Company undertaking for the sum of £2 500.

Huddersfield T.C. It has been decided to instal plant for the distillation of tar at the gasworks.

Ripon T.C. It is proposed to provide new retorts at the gasworks at an estimated cost of £450.

Rochdale T.C.—A sub-committee of the Works Committee have been authorised to report upon a proposal to spend an estimated sum of £50,000 upon the extension of the electricity works.

Rochford R.D.C. The surveyor, Mr. H. T. Sidwell, has received instructions to report upon a proposal for the improvement of the Canewdon water supply.

Stalybridge T.C. A scheme is to be prepared for the provision of a coal-tar and benzol recovery plant at the gasworks.

MISCELLANEOUS.

Aberdeenshire C.C. It was reported to the Garioch District Committee that in regard to the fixing of the salaries (travelling allowance, &c.) the Local Government Board had sent a letter intimating that they did not propose interfering in the matter of increasing expenses. They took no exception to the arrangement proposed, but they asked that the minutes should be amended to show a note of the expenses to be incurred, and at the end of next year the Board would see what steps should be taken for the future.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATION FOR LOAN.

Aldershot U.D.C. £1 000 for the construction of an underground convenience.

LOAN SANCTIONED.

Rochford R.D.C. £3 317 for sewerage works.

FORTHCOMING INQUIRIES.

			£
		AUGUST.	
30	**Blackburn.**	For the extension of the gas works (Mr. A. G. Dodd.)	71 568
		TOWN PLANNING.	
		SEPTEMBER.	
13.	**Neath.**	(Mr. George L. Pepler)	—

FOR OTHER ADVERTISEMENTS
See End of Paper.

RHONDDA URBAN DISTRICT COUNCIL. [illegible] and sewage works. The sewerage works can be [illegible] and will be offered for tender by persons or firms [illegible] Engineer to the Council, to whom application should be made for particulars as to details, &c., and Form of Tender. Completed Tenders are to be received by the 12th September next.

E. HAZLEDINE BARBER, Assoc. M. Inst. C.E., Engineer and Surveyor.

County Offices, Pontypridd. August 23 1916. £367 4.

THE TOWN COUNCIL of the BOROUGH of DEVIZES [illegible] proposal about to be [illegible] Offices for purchase of the [illegible] be sent to the Borough Surveyor [illegible] Devizes, by Friday, 1st September [illegible]

PERSONAL.

Mr. A. E. Bush, surveyor and sanitary inspector to the Beeston Urban District Council, has resigned after twelve years' service.

Mr. George Lapwood, surveyor to the Romford Rural District Council, who has undergone an operation, is progressing satisfactorily.

Mr. E. Leslie Wright, architectural assistant in the Mansfield borough surveyor's department, has joined the Forces.

Mr. J. E. Crowson, assistant surveyor, has been appointed surveyor to the Peterborough Rural District Council.

Mr. J. B. Sobey, surveyor to the Southern District of the Liskeard Rural District Council, has had his salary increased by £25 a year.

Mr. Robert B. Leach, electrical engineer and tramways manager to the Heywood Town Council, has been appointed to a similar post at Loughborough.

Mr. A. Cooke, Little Hulton, Bolton, has been appointed surveyor to the Darfield, Yorks, Urban District Council, at a salary of £120 a year.

Mr. Isaac Matthews-Jones, for nearly forty years city surveyor of Chester, and now retired, has been bereaved, we regret to state, by the death of his wife, which took place at Southport.

Mr. J. Walsh, county surveyor of Louth, has had his salary increased from £300 to £400 a year, and Messrs. J. Dromgoole and J. M. Lyons, assistant surveyors, have been voted an advance from £130 to £150 each.

Mr. Hardy, surveyor to the Whitley Upper (Yorks) Urban District Council, has received a vote of sympathy from the council upon the death of his son, Mr. Henry Hardy, in the war. Mr. Hardy only recently lost his wife.

Mr. George Lee, assistant county surveyor of Galway, has been appointed county surveyor for the Eastern Division of the county. Mr. Michael A. Martin, Portumna, has been appointed temporarily to fill the position in the Western Division vacated by Mr. Lee.

Mr. C. H. Cooper, M.INST.C.E., the borough engineer of Wimbledon, whose paper on road direction signs, read at the annual meeting of the Institution of Municipal and County Engineers, at Blackpool, is reproduced in this issue, is one of those men who is never happy unless working on an independent line. It was when he took up motoring that he realised the necessity for readable direction signs and to meet the need devised the system illustrated in his paper. In consequence of the troubles met with in the lubrication of internal combustion engines, Mr. Cooper designed a system by means of which the lubricant to each cylinder is independently controlled and only admitted at the end of the explosion stroke so as to minimise the deposit of carbon (Patent No. 15,374). Reference to maps when on the road, especially on a wet and windy night, is one of the things that has troubled our friend. But to meet this difficulty he has devised a watertight holder which, in a space of 9½ in. by 9½ in. by 2 in., contains maps to a scale of 2 miles to the inch, covering 120 by 72 miles of country, all of which may be referred to without opening the case and can be read at night by electric lamps contained in the case (Patents Nos. 3,980 and 13,787). Mr. Cooper's inventions in connection with the card index and the treatment of sewage will be recalled by many of our readers.

OBITUARY.

Mr. R. G. Hawke, for some years surveyor and inspector to the Glossopdale Rural District Council, died recently, we regret to state.

With deep regret we learn of the death, which occurred on Monday morning last, of Mr. Frederic William Manuelle, of the firm of A. & F. Manuelle, granite quarry owners, and marble and stone merchants, Bishopsgate House, E.C. The business will be continued under the same name as heretofore, and Mr. James Leigh, who has been connected with the company for the past forty years, will continue to act as manager.

KILLED IN ACTION.

Private Norman Howard, Royal Fusiliers (Public Schools Battalion), killed in action on July 20th, was the elder son of Alec and Annie Howard, of Petrograd. Before joining the Army in September, 1914, he was associated in business with Messrs. Joseph Jackson & Son, civil and mining engineers, Wood-street, Bolton. He was a fellow of the Surveyors' Institution.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Are not some municipal authorities relying on a rather quicker termination of the war than is likely to take place? Was it, for instance, prudent of the Lewes Town Council to keep down their district rate to a normal 2s. in face of the recommendation of their Finance Committee to raise it to 2s. 1d. in the £? Is it not more than possible that even when peace comes the spending value of the £, which is now only 12s. 6d., will be still further reduced owing to the rise in wages and commodities which always follows after a war of any duration?

* * * *

Has not the world of housing, as well as that of politics, lost a very useful man by the death of Sir Arthur B. Markham? Is it generally known that he was a thoroughly practical social reformer, and was "justly proud," as stated in the *Westminster Gazette*, of the garden city he had erected at Woodlands, in Yorkshire, for the miner class? Will not the solution of this at present almost insoluble problem of sufficient housing accommodation be eventually found in the activities in this direction of large-minded men of Sir Arthur's type, and not through the Socialistic idea of State-aided dwellings, which contains so many troublesome pitfalls?

* * * *

Is not a surveyor sometimes placed in a very awkward position when he asks his council to apply to the tribunal for the exemption from national service of one of his staff whom he deems to be indispensable, and the council decline to take any action? Was not this evident in a recent case in Sussex where the surveyor asked for the exemption of a road foreman, and one of the councillors remarked that he would "rather see the roads go to pot than that men should be kept back from the Army"? Is there not, however, a great deal to be said in favour of this remark, when it is considered that our one object at the present moment is to win the war, and that if wholesale exemptions are allowed this might prove impossible.

* * * *

Why is it that gargoyles on Cathedrals and other ancient buildings nearly always depict hideous or grotesque abortions? Is it that even the stonemasons of those far-off days realised that there is something blatant and egregious in a "spouter"?

* * * *

Are there not two remarkable facts that strike an intelligent observer when looking down upon London from, say, the dome of St. Paul's Cathedral? First, the large number of green trees that can be seen dotted about everywhere between the roofs of buildings, and, secondly, the absence of black smoke from the factory chimneys? Should not this latter fact be a source of congratulation to the members of the Smoke Abatement Society?

* * * *

Why was it that, according to the *Dublin Evening Herald* of the 2nd inst., some of the members of the Rathmines Council should have been so much exercised in their minds about the street lighting, which, apparently, for purposes of economy only, was to be reduced during the month of August? Are these councillors aware that in England there are a considerable number of towns, larger than Rathmines, which have to put up with this inconvenience, not only for reasons of economy, but because we are at war?

* * * *

Is not Dr. Caldwell Smith's suggestion for the destruction of the larvæ of flies a good one? Could anything be more simple than to spray house refuse and dustbins with a mixture consisting of half a pound of soft-soap, half a pint of paraffin, and a pint of water? Is it not very satisfactory to read that, after many experiments, Dr. Caldwell Smith found this simple, and cheap, remedy perfectly efficacious?

REINFORCED CONCRETE ROAD CONSTRUCTION.

By W. Matthews Jones,
City Engineer, Chester.

[The following extracts are from an article which appears in the latest issue of "Road Reinforcement," the artistic little booklet which the manufacturers of the B.R.C. Fabric, the British Reinforced Concrete Engineering Company, Limited, Manchester, publish from time to time.]

I have come to the same conclusion with regard to concrete roads as our American friends have done, and in Chester I am going very strongly to advise my council, when the war is over and men and materials are obtainable, to go in for reinforced-concrete roads as the standard type for Chester.

I have seen other concrete roads than those laid in Chester, but I do not agree entirely with their method of construction, neither do I agree, in many cases, with the way that the reinforcement is laid in the concrete which is used for road-foundation work. The method generally adopted for this is to take a roll of the reinforcement, unroll it for its whole length (50, 75, or 100 yds., whichever it may be) on that portion of the roadway already excavated, and then to place 2 in. or 3 in. of concrete on the top of it, and raise the reinforcement up through this so as to be this distance away from the underside of the concrete. This method, in my opinion, is entirely wrong, because the work cannot be done satisfactorily in this manner, neither do I agree with the stronger bars of the reinforcement being laid in the same longitudinal line as the roadway, and I do not think I can do better than give a very short statement of what I do in Chester.

In the first place I take into consideration the traffic likely to use the road to be laid; secondly, the nature of the soil underneath on which the concrete is to be laid. Having arrived at these facts, I then consider the thickness of the reinforced concrete to be used, get this fixed in my own mind, and set to work. In reinforced-concrete roadwork it is a great mistake to have your broken granite all of one size—that is, say, 1-in., 1½-in., or 2-in. mesh, or whichever the surveyor may decide on is required for the road surface. What I do is to get my stone of the various meshes in proportion—that is to say, 1 ton of 2-in. mesh, 1½ tons of 1½-in. mesh, 1½ tons of 1-in. mesh, 1½ tons of ¾-in. mesh, and 1 ton of ¼-in. mesh. These I have tipped together and turned over in a dry state, the same as turning over the concrete. When they are properly mixed I then make my concrete in the proportions of 5, 6, or 7 to 1, as the case may be. This when thoroughly mixed makes a far better conglomeration or matrix than having stones of the various sizes put in according to their mesh. What one wants is a solid piece of work, with no voids of any kind, but one homogeneous mass.

If the substrata or soil underneath the concrete is wet or of clay, I spread 2 in. of ashes first, and on this spread out 2½ in. or 3 in. of concrete for a length of anything from 25 to 50 yds. by the full width of the carriageway. By this method it will be observed that the bottom layer of the concrete is laid to an even thickness, and on this I place my reinforcement, not with the stronger bars the longitudinal way of the street, but transversely across the carriageway. The reinforcement sheets being 7 ft. in width, I cut off the lengths to fit the carriageway, and take great care that where two edges join one another in the longitudinal section these are properly wired together by bending over the thin portion of the reinforcement one to the other. Having put this area down, and while the concrete underneath is quite fresh, I then proceed to put on my top layer. This is roughly trammelled over, and is brought to a fairly good surface by the men using their spades, and is left in this condition without any floating, the rough concrete being brought to the required height. I might say that I generally allow the wet concrete to be brought up ¼ in. higher than the finished level required, and this allows for any consolidating which may go on through its own weight or evaporation of the water.

Water Economy in London.—Sir John Wolfe Barry has called attention to the waste of water in London, and Mr. E. B. Barnard, chairman of the Metropolitan Water Board urges greater economy by consumers. The rise in the cost of coal and the increase of wages, he stated, has increased the expenditure of the board by £174,000. The water charges of the board are fixed by statute.

MUNICIPAL WORK AT BRISTOL.

POINTS FROM CITY ENGINEER'S REPORT.

In consequence of the war and the urgent need for the exercise of economy, the report for the year ended March 25th last of Mr. Lessel S. McKenzie, Assoc.M.Inst.C.E., the city engineer and surveyor of Bristol, contains very little beyond a description of ordinary maintenance work. The expenditure for the year out of revenue was £226,063, as compared with £242,209 in the year immediately preceding the war. Included in this expenditure is a sum of £5,633 paid in allowances to the men who have joined the colours, and another £1,500 paid in war bonuses, so that the actual saving on work amounts to £23,269, notwithstanding the fact that there have been increases in the rates of pay and in the price of materials.

ROAD WORK.

A considerable amount of road and paving work has been carried out at the request of the Road Board, acting for the military authorities, the value of this amounting to about £3,630.

Trial lengths of bituminous roads laid in various parts of the city are still very satisfactory; but, under present conditions, any extension of the work is out of the question. However, unless the price of timber should drop considerably, it may be necessary, Mr. McKenzie states, to consider the substitution of bituminous material for some of the worst of the wood paving, some of which is getting into very bad condition.

The macadam roads have not been allowed to go back, it being considered a sounder policy to keep them, as far as possible, in good repair. Tar-painting the surface was again carried out over a very large area and on looking through previous reports it is satisfactory to note that in 1906—the last year before the introduction of this treatment to the Bristol roads—the number of loads of road sweepings and slop carted away was 80,597, as compared with 58,410 during the year under revision, and that the number of loads of water used for street watering was 135,657 against 58,799 loads.

Two Laffly petrol-driven rotary brush machines have been running for twelve months, and are very satisfactory. They are more efficient than horse machines, and the city engineer anticipates a saving of at least £150 per annum on each machine.

SATISFACTORY STEAM LORRIES.

In connection with the equipment of plant for the construction of bituminous roads, two steam lorries were purchased from the Yorkshire Commercial Motor Company, of Leeds, at a total cost of £1,090, and have been engaged continuously on work being carried out by the corporation for the Government. Each lorry has a total length of 16 ft. 3 in., and width of 6 ft., with a wheel base of 9 ft. 9 in., and weighs 2 tons 19 cwt. The carrier is lined with sheet steel, is fitted with mechanically-operated tipping gear, and carries 3 tons. The working steam pressure is 175 lb. per square inch, and the speed is up to 12 miles per hour. The road wheels are of the "Artillery" type, and are fitted with solid rubber tyres.

Up to the present the lorries have given complete satisfaction.

During the period covered by Mr. McKenzie's report private streets of a total length of ·98 of a mile were made up, at an average cost of 9s. 9·72d. per foot of frontage.

In the laying of pitched sett paving in old highways the area covered by 1 ton of setts averaged 4·09 super. yds.

To streets already paved with wood an area of 1,085 super. yds. of Jarrah paving was added during the year, making the area of wood paving in the city maintained by the corporation 243,032 super. yds. The macadamised carriageways in old highways recoated and relaid was about 70½ acres, equivalent to a length of about 27¾ miles, with an average width of 7 yds. Of this work about 10¾ miles was in macadam treated with tar and other compounds.

The average area covered by 1 ton of stone in recoating was about 12½ super. yds.

HORSE HAULAGE.

As regards the work done by the corporation and hired horses, Mr. McKenzie states that each horse worked on an average 310½ days during the year, the average number of loads hauled per horse being as follows: Street cleansing, 3·73; ashing (removal of house refuse), 2·79; street watering, 14·92; material-

for paving, pitching, macadamising and sewers, 4·50. The stone hauling is done by contractors: the total number of tons hauled during the year was 27,365, the average cost per ton being 1s. 6d.

The cost for forage per horse per day averaged 2s. 8·55d., the highest outlay in any one week having been 3s. 6·83d., and the lowest 2s. 3·19d. per day. The average cost of bedding was 1·56d. per horse per day. The cost per horse per week averaged 19s. 10·77d., compared with 13s. 1·36d. during the period prior to the war.

During the year the total amount of refuse destroyed at the corporation's two destructors was 57,842 tons, and the amount of clinker obtained was about 35 per cent, or a total of 20,346 tons.

ELECTROLYTIC DISINFECTING FLUID AT POPLAR.

Since the installation by the borough council, ten years ago, of a plant for its manufacture, 418,779 gallons of electrolytic disinfecting fluid have been manufactured at Poplar at a cost for electricity of £450, and materials £381—under ¼d. per gallon.

In his report for the year 1915, Dr. Frederick William Alexander, the medical officer of health, states that the fluid has been in great demand by the public at the various depots from which it is distributed. The quantity manufactured was 36,985 gallons, but before distribution the fluid was broken down to half strength.

COST OF MATERIAL AND ELECTRICITY.

The cost of material in manufacturing 36,985 gallons of the electrolytic fluid was as follows:—

	£	s.	d.
Electricity, 7,776 units at 1½d. per unit	48	12	0
Chloride of magnesium, 3¼ tons ...	19	13	9
Salt, 55½ tons ...	9	3	7
Caustic soda ...	5	8	0
Water ...	1	13	11
Total cost of materials to produce 36,985 gallons ...	£84	11	3
Electric motor for stirring: 210 units ...	1	6	3

BOTTLES, CORKS AND LABELS.

Bottles ...	16	19	0
Corks ...	9	0	0
	£25	19	0

The public health department is not only furnished with the disinfectant and the various institutions of the council (the public baths, &c.), but the institutions of the managers of the sick asylum and of the board of guardians (within and without the borough) are supplied with an unlimited quantity free.

For the fluid supplied to the works department, a charge of 1d. per gallon is made; the public health department is credited with this amount although no actual monetary transaction takes place.

As applicants now usually bring their own receptacles to the depots there is a very appreciable saving in the expense on bottles alone.

From October last for electrolytic disinfectant supplied to manufacturers and trading concerns, a charge of 8d. per gallon has been made through the electricity department, the electricity undertaking being allowed an amount of 10 per cent for establishment charges.

Some 660 gallons were supplied to four London County Council public elementary schools for spraying and cleansing floors of class rooms.

The fluid continues to be added to the water in the swimming baths in the same quantity and strength as before—viz., 1 part of chlorine to 2,000,000 parts of water. Some 3,487 gallons were supplied to the Poplar Baths, 2,925 gallons to the Bow Baths, and 1,461 gallons to the Island Baths, making a total of 7,873 gallons.

Canadian Waterworks.—Canada has spent approximately £25,000,000 on waterworks. In 1850 there were only three plants in Canada; in 1875 there were 15, and in 1900 there were 235. There are now 528 plants, of which 109 were built between 1910 and 1915. The period showing the greatest activity in the construction of such plants was between 1905 and 1910, when no fewer than 122 new plants were placed in operation. The average daily consumption for all towns and cities in Canada is 111 gallons per capita.

ELECTRIC VEHICLE DEVELOPMENTS.

RECHARGING STATIONS.

An indication of the increasing popularity of the electric-battery vehicle is to be found in the announcement that the British Thomson-Houston Company, Limited, and Messrs. Willans & Robinson have made arrangements at Rugby for the charging of electric vehicles. Parenthetically, we might mention that the General Vehicle Company, Limited, of Imperial House, Kingsway, W.C., are arranging for a zone of recharging stations around London and other big cities. This is a material consideration to those who are contemplating the addition of an electric to their existing fleet of motor vehicles.

MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL MEETING PROGRAMME.

The annual meeting of the Municipal Tramways Association will be held at the Surveyors' Institution, Westminster, on Thursday and Friday, September 21st and 22nd.

The proceedings will open at 11 o'clock on the Thursday, when Mr. Peter Fisher, general manager of the Dundee Corporation Tramways, will deliver his presidential address.

The following papers will be submitted for discussion:

"Some Notes on Passenger Transportation in Large Cities," by Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways.

"Utilisation of Tramways for Goods Traffic," by Messrs. G. W. Holford, general manager of the Salford Corporation Tramways, and W. Clough, general manager of the Bury Corporation Tramways.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

HIGHWAY SURVEYOR.—August 26th.—Claypole Rural District Council. £150.—Mr. A. J. Franks, clerk, 24 Lombard-street, Newark.

SURVEYOR'S ASSISTANT.—August 26th.—Hemel Hempsted Town Council. £80 to £100, according to experience.—Mr. W. R. Locke, borough surveyor, Town Hall, Hemel Hempsted.

GAS AND WATERWORKS MANAGER.—August 28th.—Devizes Town Council. £200 per annum.—The Town Clerk, Devizes.

ASSISTANT ENGINEERS.—August 28th.—Port of London Authority.—Chief Engineer, 109 Leadenhall-street, London, E.C.

SURVEYOR AND INSPECTOR.—August 28th.—Seaton Delaval Urban District Council. £150 per annum.—Mr. W. D. Soulsby, clerk, 3 Stanley-street, Blyth.

ELECTRICAL ENGINEER.—August 28th.—Corporation of Heywood. £200 per annum. — Mr. G. G. Bouchier, town clerk.

ASSISTANT IN SURVEYOR'S OFFICE.—August 29th. — Leek Urban District Council. — Mr. W. E. Beacham, engineer and surveyor, Town Hall.

SURVEYOR AND INSPECTOR.—September 1st.—Beeston (Notts) Urban District Council. £225 per annum.—Mr. W. H. Redgate, clerk, Bentinck Buildings, Wheeler Gate, Nottingham.

COUNTY SURVEYOR'S ASSISTANT. — Somerset County Council. £120 per annum.—Mr. Gordon R. Folland, acting county surveyor, 13 Chamberlain-street, Wells, Somerset.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

BELFAST.—August 28th.—For the erection of a central tuberculosis institute, for the corporation.—Messrs. Young and Mackenzie, architects, Scottish Provident-buildings.

ROAD MAKING.

REINFORCE CONCRETE ROADS WITH
EXPANDED METAL.

EXMOUTH SEA DEFENCE WORKS. Expanded Steel Concrete Slope and Roadway. Length 1 mile; total width of Roadway, 65 feet.
Mr. SAMUEL HUTTON, Urban District Council Engineer and Surveyor

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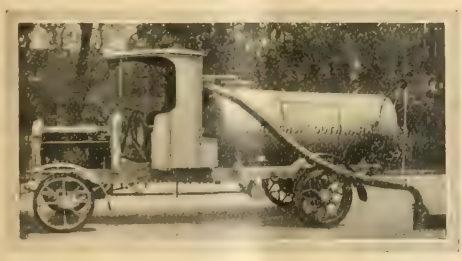
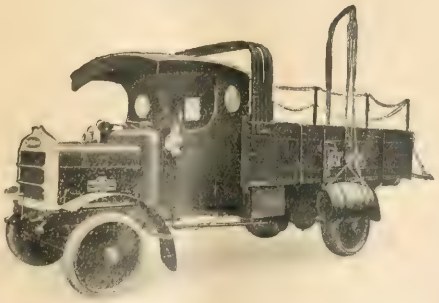


This Petrol Motor Gully Wagon in the service of the Borough of Southwark is effecting a saving of 20 per cent.



5-Ton "Straker-Squire" Wagon supplied to Messrs. Bristowe & Co., of Westminster, S.W., for dealing with tar in barrels.

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Telegrams: "Rhomboidal, Friars, London."

RATHDRUM.—August 28th.—For the erection of a cottage, for the rural district council. Mr. P. W. Sheehan, clerk.

SHEFFIELD.—August 28th.—For reinstatement after fire, at the technical school of art, for the Education Committee.—City Architect, Town Hall.

Engineering: Iron and Steel.

LONDON.—August 29th.—For the supply of one 5-ton steam tractor and three 6-ton trailers, for the Metropolitan Asylums Board.—Mr. T. Cooper, acting engineer-in-chief, Thames Embankment, London, E.C.

DUBLIN.—August 29th.—For the supply of single-phase and three-phase meters, for the Electricity Supply Committee.—City Electrical Engineer, Fleet-street, Dublin.

MANCHESTER.—August 30th.—For the erection of a refuse destructor furnace, for the Board of Guardians.—Mr. J. Macdonald, clerk, Union Offices, All Saints, Manchester.

BRADFORD.—September 5th.—For the supply of one Willans' two-crank compound engine, direct coupled to Phœnix multipolar generator, having an output of 300 kilowatts at 500 to 550 volts, and 260 cells for storage battery, made by the Hart Accumulator Company, for the corporation.—City Electrical Engineer and Manager, Town Hall.

Roads.

SCUNTHORPE.—August 30th.—For the supply of any quantity up to 400 tons of broken granite of approved quality, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, 110 High-street, Scunthorpe.

HASLEMERE.—August 31st.—For the supply of about 800 tons (more or less) of 2-in. and 1½-in. broken granite, for the urban district council.—Mr. Howard V. Snook, surveyor, Council Offices, Haslemere.

LOFTUS.—September 2nd.—For the supply of broken whinstone and slag, for the urban district council. Mr. Bernard J Wormleighton surveyor, Town Hall, Loftus, Yorks.

BEDFORD.—September 4th.—For the supply of 1,750 tons of broken granite, 4,740 tons of ironstone slag, and 1,600 tons of ironstone slag tar-macadam, for the corporation.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall.

Sanitary.

HARTISMERE.—August 31st.—For the construction of a sewer drain, for the rural district council.—Mr. H. Warnes, clerk, Council Offices, Victoria-road, Eye.

HASLEMERE.—September 1st.—For the supply of about 380 yds. of hard crushed and uncrushed clinker for use as filtering media in percolating filters, for the urban district council.—Mr. H. V. Snook, surveyor, Council Offices, Haslemere, Surrey.

EPSOM.—September 5th.—For the supply of horses and men in connection with the work of emptying cesspools, for the rural district council.—Mr. W. T. Wooldridge, surveyor, Waterloo-road, Epsom.

EPSOM.—September 5th.—For the removal of house refuse, for the rural district council.—Mr. W. T. Wooldridge, surveyor, Waterloo-road, Epsom.

ROWLEY REGIS.—September 5th.—For relaying and reconstructing sewers, for the urban district council.—Mr. W. Wright, clerk, Council House, Old Hill, Staffs.

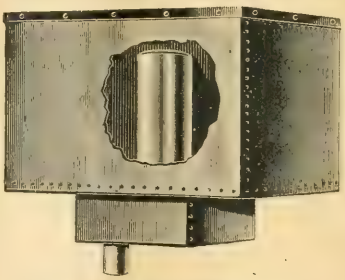
BRIGHTON.—September 6th.—For the supply of glazed drain-pipes, for the corporation.—Borough Surveyor, Town Hall.

MOTTRAM-IN-LONGDENDALE.—September 9th.—For cleansing closets and ashpits, for the urban district council.—Mr. S. Hudson, inspector.

Stores.

BRADFORD.—August 28th.—For the supply of materials for the Gas Committee.—Mr C. Wood, gas engineer, Town Hall.

BRABY'S
AUTOMATIC FLUSHING TANKS.



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for Borough Engineers and Surveyors.

We can supply YOUR requirements promptly and at reasonable prices. . Write, 'phone, wire or call. A copy of our 736 pp. CATALOGUE will be gladly sent upon receipt of application on business form.

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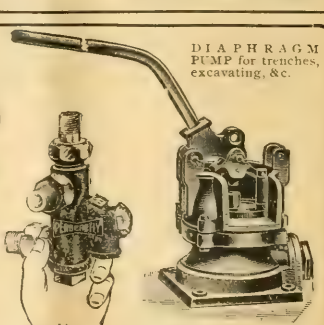
"Penberthy" Automatic CELLAR DRAINER for removing "flood" troubles.



DIAPHRAGM PUMP for trenches, excavating, &c.

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The Surveyor

And Municipal and County Engineer.

Vol. L. SEPTEMBER 1, 1916. No. 1,285.

Minutes of Proceedings.

Sanitary Problems near Camps.

There must be many surveyors in different parts of the country in whose districts military camps have been established who will be interested in Mr. G. Hartfree's paper on "Sanitary Problems in Civil Areas near Temporary Military Camps," which appears in this issue. While the military authorities can generally be relied on to see to the sanitation of the camp proper, their jurisdiction and solicitude does not extend beyond the confines of the camp. On the outskirts of the camp there are, however, other sanitary problems to be dealt with by the civil authorities, caused by the influx of visitors or relatives of the men in the camp, or by those enterprising persons who cater for the wants of the soldiers, ranging from the pedlar to the multi-millionaire provision dealer. One of the first difficulties to be encountered is that of housing these visitors in a sanitary and satisfactory manner. The houses in the neighbourhood are rarely sufficient to accommodate the new-comers, and a certain amount of overcrowding is generally unavoidable. As the demand is bound to be of a temporary, and in some cases only of a seasonal, character, it is necessary to supplement the existing accommodation by erecting a number of temporary buildings of wood, corrugated iron, or even canvas. Under the circumstances the local authority are unable to enforce the building by-laws, and the only thing to be done is to see that these temporary buildings are made as sanitary and comfortable as the unusual conditions will permit.

The simple methods of dealing with the refuse and waste of a few isolated country houses or a group of cottages, which are effective enough under normal conditions, are in the neighbourhood of camps found inadequate, and in many cases a system of refuse collection and sewage disposal of a much more effective and costly description has to be carried out. The temporary character of most of the camps makes it impossible to adopt the sanitary measures which would be desirable if the conditions were permanent, but as the necessity for the work will disappear with the end of the war, it is in the interests of the ratepayers that the sanitary provisions, while being effective, should be of a simple and inexpensive character. The difficulties with regard to water supply and the disposal of the solid and liquid wastes of the district are under such circumstances very great. There are probably not many villages where there is no public water supply, even if it is only obtained from the parish pump, but there are very many where no system of refuse collection or sewage disposal is to be found. Where a public supply of water is laid on to the houses there is often no sewerage system beyond the cesspools taking the drainage of a single house or a group of cottages. If the water supply is obtained from a well on the premises the danger of pollution from the use of cesspools is very great. Mr. Hartfree in his paper gives some useful details for the construction of wells, cesspools, and bacterial tanks in such a way as to avoid trouble from pollution. He is of opinion that the solution of the problem with regard to the temporary conditions prevailing near our camps is in strictly local action by our sanitary authorities, who should enforce the provision of sanitary requirements so far as the special conditions allow, and by the establishment of an educational assistance department, which would supply constructive and geological details with regard to water supply and the disposal of the refuse and wastes of the district. As Mr. Hartfree says in his paper, "insanitary conditions arise from ignorance or indifference," and education on sanitary matters is badly needed. It is, however, a somewhat tall order for the surveyor to be called on to supply this education to all and sundry who like to squat in his district, and it also adds greatly to his responsibility. A little knowledge is dangerous, and a course of lectures or a few pamphlets on sanitary matters, which is practically all that the surveyor could hope to offer in the way of education, is hardly likely to be very effective under such conditions, though they would doubtless prevent the more glaring mistakes which are now frequently made in rural districts.

* * *

Private Bill Legislation and Common-law Rights.

The recent case of *Place* v. *Rawtenstall Corporation* is an interesting illustration of the principle that an enactment limiting or abrogating a common law right will be construed strictly against the person or body who seeks to take advantage of it, and in favour of the party whose right is so limited or abrogated. The enactment in question in this instance was sec. 257 of the Rawtenstall Corporation Act, 1907, which provides as follows: "Whenever the corporation or the surveyor, under this Act, or any local or general Act or by-law for the time being in force within the borough, execute, re-execute or alter any work, or do any act or thing in default or at the request of the owner, occupier or other person required to do such act, work, or thing, the corporation shall not, as between themselves and such owner, occupier or other person, in the absence of negligence on the part of the

corporation, or the surveyor, or of any contractor or other person employed by them or him, be liable to pay any damages, costs, charges or expenses for or in respect of or consequent upon the executing . . . of such work . . . and any such damages . . . paid by the corporation . . . shall be part of the expenses payable by such owner, occupier or other person, and shall be recoverable accordingly." This, it will be seen, is pretty sweeping.

The facts of the case were briefly as follows: The plaintiff having made default in complying with a notice from the corporation to convert his pail-closet into a water-closet, and connect it with a sewer, the corporation did the work themselves. Unfortunately, however, for themselves, they did not confine their operations to that work, but did considerably more—that is to say they constructed a sewer to carry away the sewage not only from the plaintiff's house, but also from several other buildings, at a total cost of £54, of which the plaintiff's share was £11. It appears, however, that as a result of the work the plaintiff's house had been damaged by subsidence, and, on this ground, he not only refused payment, but claimed compensation. The matter was referred to an arbitrator, who awarded the plaintiff £46 and costs, and this action was brought to recover the amount so awarded. The corporation pleaded the above section of their special Act, but Mr. Justice Ridley, at the Manchester Assizes, gave judgment for the plaintiff, and his decision has been affirmed by the Court of Appeal on the principle above stated. In applying that principle to the facts of the case, Mr. Justice Scrutton pointed out that, inasmuch as the pipe which had been laid along the plaintiff's passage was sufficient to conduct the sewage or rain-water of eight or nine houses, it was not work in respect of which the plaintiff was "in default," and the damage did not result from the plaintiff's failure to perform "such work." "It was correct, no doubt," said his lordship, "to say that it 'included' the work which the plaintiff should have done, but it included much more, and there was no finding that the damage was caused only by the work which the plaintiff had received notice to do." The principle of construction thus followed appears to us to be a very salutary one. Parliament, of course, is omnipotent (in the region of legislation), and can, either by a public or a private Act, curtail, or even altogether abolish, common-law rights; but it is in the public interest that enactments of this kind (especially where they are contained in a private Act) should be regarded somewhat jealously, and that where (as in this case) such a clause is relied on as a defence to a claim founded on a common-law right the defendants should be bound (in order to succeed) to bring themselves within the strictest letter of the clause. This the Rawtenstall Corporation failed to do.

* * *

Sanitary Administration and the War.

Taking as his subject the catch-phrase "Keep the home fires burning," Mr. J. Siddalls, the chairman of the Devon and Cornwall branch of the Sanitary Inspectors' Association, read an interesting paper at a recent district meeting of that body, in which he discussed the question of how the sanitary inspector can best aid in keeping the home of the soldier on active service bright, cheerful, and protected for him against the time of his return. In an apt phrase he described sanitary inspectors as "the executive of the forces arrayed against sickness, disease, and death," and he emphasised the fact that in fighting these enemies of the social organism they are performing a national service in a double sense, for not only are they improving the general conditions under which the working and poorer classes live, but they are also working to make a happier welcome for our heroes when they return from the fighting-line. In speaking of the urgent need for municipal economy, he urged once more that zeal should be tempered by a wise discretion, and in the same connection he pointed out that in many towns a considerable saving can be effected by a more scientific use of waste products. True, it is probably only in the larger towns that the collection and sale of scrap iron, bottles, and tins can be made to pay, but even in small districts the separate collection of waste paper may be good business in these days of high prices. Thus, in Mr. Siddalls' own district the separate collection of waste paper has been carried out for some four years past. It will thus be seen that it was not introduced as a measure of war economy, and the original saving was confined to a reduced cost of haulage to a tip which is about 1½ miles distant. Since the war, however, prices have risen to such an extent that the past six months' working have produced a revenue 25 per cent in excess of the whole cost of collection in addition to the saving on haulage. Mr. Siddalls also referred to the effect of the war on the house-to-house inspection under the housing regulations of the Housing and Town Planning Act, 1909. It will be remembered that the Local Government Board have suggested by circular that, while not unduly relaxing the standard of public health administration, local authorities should, as far as possible, refrain from requiring the execution of work the cost of which has to be borne by private individuals, unless the work is urgently necessary for the removal of nuisances or the protection of health. There is some danger in certain quarters that this circular may be used as an excuse for lax administration, and that in consequence returning soldiers may find awaiting them unattractive and insanitary homes. It is worth emphasising therefore that it is the duty of local sanitary authorities at once to deal with and remedy all cases where any insufficient or insanitary drainage, want of proper closet accommodation, improper water supply, or overcrowding is found to exist. Mr. Siddalls is to be congratulated on having enabled his hearers to look at an old subject from a new point of view.

* * *

Housing in Edinburgh.

Writing in the current issue of the *Journal of State Medicine*, Sir William Brown, ex-Lord Provost of Edinburgh, describes the housing policy which has been pursued by the corporation of that city, and points out the special difficulty that has been experienced in dealing with the problem as it affects the very poor—and also the profligate and vicious class. Three large schemes have been carried out in Edinburgh under Part I. of the Housing of the Working Classes Act, 1890. Before these were undertaken the conditions under which the poorer citizens of the "Queen of Cities" were compelled to live were notoriously bad, but here, as in other places, a forward housing policy has been reflected in a considerably reduced death-rate. The first of the schemes referred to was promoted in 1893, and comprised ten unhealthy areas in various parts of the city. This was followed in 1898 by a second scheme for two areas at Stockbridge and Portobello respectively, while in 1900 a further scheme was initiated which included the notorious Greenside area. After these operations were completed, a most noticeable improvement resulted, which (in the words of Sir William Brown) affected not only the sanitary conditions, but also the *class* and conduct of the inhabitants in the areas concerned. The change in class was not due to any lack of effort on the part of the authorities to rehouse those actually displaced by the various clearances. On the contrary, in all cases these persons have

received a preference as tenants of the new dwellings. In the vast majority of cases, however, the offer has been refused, and accommodation has been sought elsewhere. An example is afforded by the case of Greenside, where a list of tenants to be evicted was carefully examined, each tenant was visited and a house offered at Portsburgh. Only two tenants came to see the new houses, and these they declined on the ground that there was *too much light!* The class which loves the darkness rather than the light obviously cannot be catered for directly in any municipal housing scheme, and must principally be dealt with by means of closing orders. Nevertheless, the larger policy is amply justified by its beneficent effect on the death-rate. In Edinburgh this has fallen during the last forty years from 27·8 to 14·3 per 1,000, and he would be a bold man who would deny that improvement in housing conditions has been one of the main factors in bringing about this reduction. It must be remembered too that these figures relate to the city as a whole. In the actual areas dealt with the results are far more striking, examples being a reduction from 36 to 17·1 per 1,000 in the Lawnmarket district and from 53 to 24 per 1,000 at Tron Square and High School Yards.

* * *

Security of Tenure in Ireland.

Security of tenure for the municipal engineer may not be within the range of practical politics so far as Great Britain is concerned, but, as was mentioned by Mr. J. H. Drew in his Blackpool paper recently, a form of security has been in existence in Ireland for some years past. As may be supposed, this protection is not bestowed upon the official gratuitously, for it carries with it the statutory right of the Local Government Board for Ireland to insist upon a standard of eligibility for architects, engineers, or surveyors engaged by local authorities. How the rule works in so far as its security aspect is concerned is illustrated in the proceedings recently of the Waterford County Council. A proposal was to be submitted for the increase of the salaries of the assistant county surveyors, and the chairman, Mr. Thomas Power, in the course of an explanatory speech, said: "There is another point. That is that even if you fail to come to an agreement with the assistants with regard to their request for increases of salaries, they can appeal to the Local Government Board independent of you. This was done once before in the instance of the late county surveyor. He applied for an increase here which was refused. Then he applied to the Local Government Board for redress, and they sent down an inspector. The inspector recommended the increase he sought for, and he got it. The assistants now would much prefer this matter to be settled by you than that they should seek for redress anywhere." It is noteworthy that the assistant county surveyors were voted increases of salary by the county council after an exceptionally business-like debate, in the course of which not a single councillor resorted either to personalities or to passionate protestations on behalf of the interests of the poor ratepayer. Whether this happy result was due to the knowledge that the officials were not entirely at their mercy we need not stop to inquire, but it seems undeniable that, thanks to the status conferred by the law in Ireland, the municipal and county surveyors occupy a favoured position compared with their brethren in Great Britain.

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Sludge Disposal.

The progress which has been made towards the solution of the sludge problem by means of the activated sludge process of sewage treatment has caused many to entertain great expectations, which may be fulfilled to a large extent in due course. Meanwhile, and for many years to come, there will be a large number of works where other methods will have to be adopted. So far as can be gathered from various sources the digestion of sludge after separation from the sewage has been found to work successfully. At Birmingham this was done by pumping out the sludge from the preliminary settling tanks into comparatively shallow digesting tanks, and so far as we are aware this system is still in operation there with satisfactory results. Other systems in which the sludge is allowed to digest separately are the Travis hydrolytic tank and the Imhoff tank. In the Travis tank only a small portion of the sewage flows through the digestion chamber, while in the Imhoff tank the sewage is entirely separated from the sludge. A considerable number of Imhoff tanks have been in operation for some time, especially in the United States, with good results, but it appears from an article in *Engineering Record*, which is printed on another page, that attempts are being made to overcome certain difficulties which have arisen in connection with these tanks by removing the partly digested sludge at frequent intervals and subjecting it to further digestion in a separate tank.

The details given in the article are very interesting, and are worthy of careful study. Unfortunately the method recommended involves pumping — a troublesome matter when dealing with sludge, and necessitating an increase in the cost of maintenance which every sewage works engineer does his utmost to avoid. One of the great advantages of the Imhoff method of sewage treatment is that the sewage is kept as fresh as possible, and is not fouled by the products of the anaërobic decomposition of the sludge, so that its subsequent treatment on filters or otherwise is carried out with the least possible risk of creating a nuisance. Where sufficient fall is available the separation and separate digestion of the sludge can be arranged without pumping, but there are so few cases where this is possible that the question of its adoption will involve careful consideration of the increase in the cost of maintenance due to the necessity of pumping the sludge.

* * *

Corrosion Research.

As a result of the recognition some six years ago of the need for a thorough scientific investigation into the question of the corrosion of condenser tubes, a Corrosion Research Committee was set up by the Institute of Metals. Research has up to the present been conducted at Liverpool University, and three valuable reports have been issued. An extension of the operations of the committee has recently been rendered possible owing to the receipt of a substantial grant in aid from the Government, and by an excellent arrangement it has been decided that the committee should in future conduct its operations in the Southwick power station of the Brighton Corporation. The advantage of the new venue arises from the fact that the Southwick power station is on the coast, and thus affords facilities for the use of sea water by the committee's plant. Indeed, it may be said that in future there will be a State-aided corrosion research station working under almost ideal conditions as regards supplies of water and power and atmosphere. The offer of the corporation was made at the instigation of Mr. John Christie, M.I.E.E., to whom great credit is due, and their action in thus associating themselves with this work should set an example to municipal and other bodies of the possibility of assisting in that co-ordination of scientific and industrial research that it is one of the main functions of the Government Research Council to effect.

Road Board Laboratory Tests.

By H. P. MAYBURY, M.INST.C.E., COLONEL R. E. CROMPTON, R.E., and DR. T. E. STANTON.

[The following report on tests carried out in the road testing machine at the Road Board Laboratory, Teddington, appears in the form of an appendix to the Board's fifth annual report, a brief notice of which was given in our issue of last week.]

The testing of road materials under the instructions of the board was begun in the course of the year 1911. In addition to laying down many kinds of surface materials on test lengths of a road at Sidcup and elsewhere, laboratory apparatus for testing the qualities of road-stone was ordered from the United States and installed in the board's department of the National Physical Laboratory at Teddington.

Later in the year it was seen that this laboratory plant might be advantageously supplemented by a form of testing machine in which road material could be laid down as if it were a part of an actual roadway, and subjected to the rolling, hammering, and abrasive action of loaded wheels driven over it at speed. This appears to be a mode of testing which in some respect affords a more accurate means of comparison of certain qualities of these materials than is possible when the material to be tested is laid in the open, exposed to the varying conditions of moisture and varying temperature of our climate, and to irregularity of traffic, for these varying conditions render accurate comparisons difficult, so that the comparisons which can be made between the materials tested are necessarily uncertain and largely a matter of individual opinion.

The design for the road machine was prepared, and after delays caused by the novelty of the problem, it was set to work on preliminary tests during the summer of 1913.

The results of the more recent tests afford valuable information to which the attention of road authorities, engineers and surveyors may be called. In addition to showing that these bituminous surfaces when carefully made and laid are likely to be durable and economical, the tests appear to throw light on several of the causes of past failures, and indicate means by which such failures may be avoided or minimised in future.

THE ROAD TESTING MACHINE.

The road testing machine consists of a revolving frame supported on wheels running on a test path. The circular test path is 34 ft. diameter, and has a working width of 2 ft. The road material is laid down on a concrete foundation. On the surface to be tested the machine revolves at any desired speed, but when steel tyres are used, as has hitherto always been the case, this must not exceed 7 miles an hour.

The road machine framework is supported by eight wheels, each 3 ft. 3 in. diameter by 3 in. tyre width. Each of these eight wheels is driven by its own electric motor, so that the action on the test surfaces is nearly the same as that of a driving wheel of a motor lorry loaded to the same weight. In most cases the weight per inch of tyre width has been about 470 lb., but during the consolidation stage this has been sometimes increased to 750 lb., which is approximately the maximum allowed by the Local Government Board regulations.

The test surface may be kept either perfectly dry or it may be sprayed to any desired degree of wetness, and as wetted surfaces can be tested to destruction sooner than when the track is kept dry, the wet test has now become the standard of comparison. During a wet test the whole of the material worn off by attrition can be collected and weighed, and thus the loss of material from actual wear can be accurately measured. The temperature of the test room may be maintained at any desired point between that of the summer and winter seasons, and as bituminous materials soften and show the least resistance to deformation during the summer months, a temperature approaching that of summer has generally been maintained.

HOW TESTS ARE CARRIED OUT.

The tests are now carried out in the following manner: A manufacturer of road material, or a road authority desiring to have his material tested, sends about 3 tons of it ready mixed, in a motor wagon, so covered and protected from loss of heat that it can be delivered at a sufficiently high temperature, which is usually from 300 deg. to 330 deg. Fahr., to be soft and plastic enough to be properly laid and finished. The hot material is filled into the track, then levelled by raking to the depth required to consolidate it to a finished carpet 1½ in. thick; the consolidation is then carried out by rolling it with the machine, or by hand rolling, or by tamping, as makers prefer.

At the time the track is laid test samples are made in separate moulds and preserved for reference. The machine is then started and run on the new surface with a gradually increasing load until about 4,000 to 6,000 tons per yard of width have rolled over it—this is called the consolidation period.

The test proper then commences—the machine is run at a load of 470 lb. per inch of width at a rate of about 2,200 tons per yard of width per hour; the running hours are about eight per day, the track being kept wet all the time. The condition of the track is observed twice a day or oftener, and any defects which may appear are entered on the test sheets. The material worn off by attrition is collected as mud, dried and weighed. In most cases with good material a well-laid surface remains smooth and polished and but slightly marked until about 200,000 tons per yard of width have rolled over the track. Generally about this stage wave-like markings begin to appear. These gradually extend themselves until at 400,000 tons the surface becomes considerably waved, so that the vibration caused and communicated to the machine and building is excessive, and the test is then considered complete. Plaster casts are then taken to record the shape and the condition of the road surface—usually one of these is taken at the worst point where the surface is most waved, and another at the point where it is smoothest. Test pieces are cut out and their density compared with the first set of samples, so that the increase of density during the test can be recorded.

FOUR SETS OF TESTS.

The four sets of tests now published—three of these showing good results and one a failure due to well understood causes—show that upwards of 400,000 tons per yard of width can be obtained in this machine, and as makers gain experience by watching the behaviour and relative deformation of their material during the various stages of consolidation and subsequent deformation, it appears quite reasonable to expect that further progress will be made.

The above results should be considered as laboratory tests purposely made as destructive as possible so as to be of value for comparison of wear-resisting properties. Some of the materials have been in practical use for a considerable time, and have already carried under ordinary traffic conditions a weight of traffic in excess of that shown in these tests. The laboratory figures must always be regarded as relative and not as indicating the weight of traffic which the materials will carry when laid on the road.

The principal figures of the four tests are shown arranged in four vertical columns in Table I., so that the nature and quantity of the materials used and the rolling load carried in tons per yard of width being arranged side by side, can be readily compared. It will be seen that, as was expected, as the test goes on, the density of the material measured by its specific gravity gradually increases; this, of course, is not regular throughout the thickness of the material, but is generally greatest at its upper surface.

As would be expected, tests for water absorption which are carried out by cutting samples from the track at the end of the test and soaking them in water for a period of three months, noting their increase in weight at the end of the soaking period, show that the water absorbed is to some extent in proportion to the percentage of voids in the material indicated by the difference between the specific gravity of the consolidated material and its specific gravity calculated as if it were absolutely free from voids.

Additional tests, such as resistance to impact, have not yet been carried out sufficiently fast to enable them to be valuable as indications of over-hardness

ROAD BOARD LABORATORY TESTS: TABLE I.

Test No.		—	9	10	11	12
Particulars of material		—	*Bituminous Sand Carpets using Residual Bitumen.*			
Make of bitumen		—	Mexphalte	Mexphalte	Aztecphalte	Aztecphalte
By whom laid		—	Highways Construction Company	Sutton (Surrey) Urban District Council	Essex County Council and Messrs. Constable, Hart & Co.	Messrs. Constable, Hart & Co.
Composition of mixture	Proposed	Bitumen per cent	13	13	10·8	14
		Filler per cent	14·5 (Portland cement)	20 (Portland cement)	4·05 Blue Lias lime	8 (Portland cement)
		Sand per cent	72·5	67	85·15 (sand and limestone dust)	78 (sand and limestone dust)
	By analysis	Bitumen per cent	12	11·75	12	14
		Sand and filler per cent	88	88·25	88	86
Grading of sand and filler		Passing 200	15	19	5	14
		„ 100	16	7	7	8
		„ 80	13	4	10	7
		„ 50	25	33	68	50
		„ 40	8	25	8	13
		„ 30	7	2	1	1
		Retained on 30	16	10	1	7
Method of mixing		—	Batch mixer	Batch mixer	Batch mixer	Mastic mixer
Temperature of mixing		Deg. F.	380	340	295	500
Temperature of laying		Deg. F.	260–350	210–325	200–260	325–415
Method of obtaining consolidation		—	Tamping and smoothing	Tamping and smoothing	Tamping and smoothing	Tamping and smoothing
Amount of consolidation		—	Considerable	Considerable	Small	Considerable
Result of test	Consolidation stage (slow speed)	Tons per yard width	4,550	4,716	5,370	6,144
	Wet stage (6 M.P.H. approximately)	Tons per yard width before excessive vibration	212,100	124,700*	25,960	458,200
Deformation of surface obtained from sections of the test road		During consolidation stage	0·02 in.	0·00 in.	0·12 in.	0·03 in.
		During wet stage	0·08 in.	0·07 in.	0·07 in.	0·05 in.
		Total	0·10 in.	0·07 in.	0·19 in.	0·08 in.
		Per cent deformation on original thickness of surface	5·6	4·7*	12·7	5·3
Specific gravity		When laid	2·10	2·11	1·82	1·97
		At conclusion of test	2·12	2·13	1·94	2·08
		By calculation (voidless)	2·28	2·31	2·24	2·21
Per cent consolidation		—	1·0	0·9	6·6	5·6
Per cent of voids		When laid	8·6	9·5	23·1	12·2
		At conclusion of test	7·5	8·5	15·5	6·25
Absorption of water		Per cent	2·5	2·6	7·4	†

* Not including test after patching.

† This test is still proceeding.

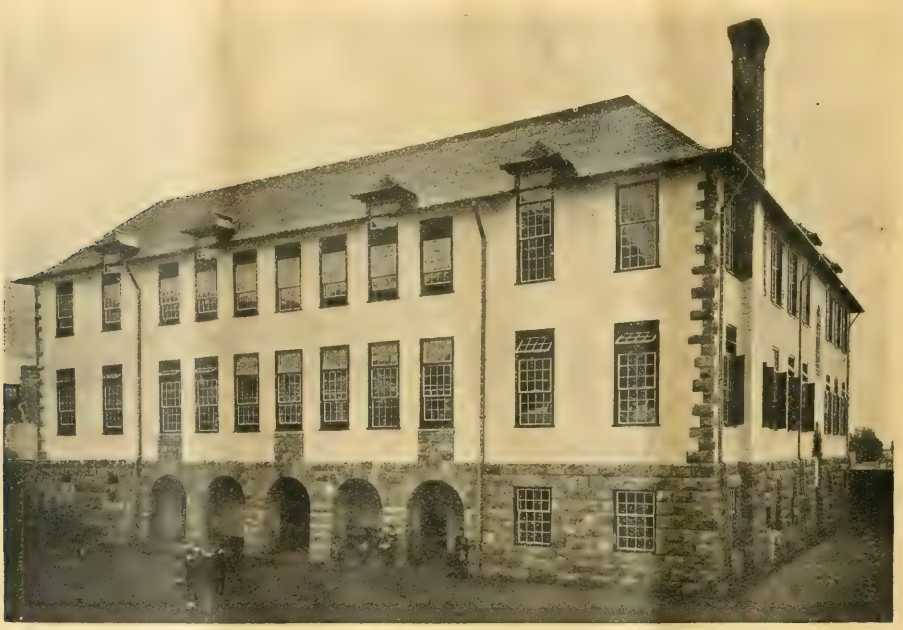
or brittleness, but as far as they have gone they seem likely to have considerable value.

During the course of the tests longitudinal and transverse sections were taken of the surface of the road. A special apparatus was constructed to do this by which the amount of the vertical displacement was doubled; the formation of hollows was therefore easily detected. The amounts of the deformation given in Table I. were obtained from the sections with the aid of a planimeter.

We have confined the particulars set forth in this report to the tests commencing with test road No. 9. The previous tests carried out were experimental, being mainly intended to determine the best working conditions for the testing machine, and we understand that you have decided that it would be unfair to publish the details of these preliminary tests in comparison with test No. 9 and subsequent tests, the results of which can be relied on as accurate.

SCHOOL BUILDING IN SOUTH AFRICA.

The accompanying photographic view illustrates an interesting type of school building which has been erected by the education authorities of Cape Town at a cost of £14,500. Accommodation is provided for 600 children.



New School in Cape Town.

All the conditions called for a compact plan, and thus the building evolved inself into the following form: The classrooms are grouped round a central courtyard, and are carried up two floors. Two entrances are provided, each giving on to a staircase which communicates with both floors. The fall of the ground has been adapted in such a way that on the lower ground level are found cloak-rooms for boys and girls, separate covered playgrounds for both sexes, woodwork room, two large kindergarten rooms, cookery rooms, four classrooms, in addition to a snug room for the principal and one for the women teachers. The first floor contains nine classrooms, together with a library and a room for men teachers.

The architects are Messrs. Herbert Baker and Kendall, and the contractor is Mr. J. L. Drake, of Cape Town.

The Kahn system of reinforced concrete was used in the construction of the building.

PUBLIC WORKS LOAN BOARD.

ANNUAL REPORT.

In their report for the year 1915-16 the Public Works Loan Board state that in accordance with the arrangements made with the Treasury they have granted loans only where it could be shown that their purpose was (*a*) urgently necessary in the national interest for the furtherance of the war, or (*b*) of urgent necessity for reasons of public health.

The board have thus continued their policy of assisting in curtailing capital expenditure and fresh borrowings by local authorities and others, in view of the necessity of preserving the capital resources of the country in the national interest. Sanction has only been given to loans which satisfied the above-stated conditions, and the effect of these restrictions has been very materially to reduce the amount advanced by the board during the year.

Of the new loans granted during the year, and amounting to £1,152,716 (as compared with £4,973,855 during the previous year), no less than £554,328 represents loans under the Housing of the Working Classes Acts for providing dwellings for munition workers in various centres, leaving only £598,388 as the whole of the other loans, £16,532 of which sum was granted to county associations under the Territorial and Reserve Forces Act, 1907, the bulk of the remaining £581,856 representing unavoidable expenditure incurred in respect of contracts entered into before the war, only a small proportion being due to expenditure of urgent necessity for reasons of public health.

The advances actually made by the board during the year numbered 842, the whole amounting to £1,864,224, as compared with 1,982 advances for sums amounting to £4,698,602 in 1914-15. Of the total for the past year, £1,864,224 was advanced on security of local rates, and the remainder on the security of property.

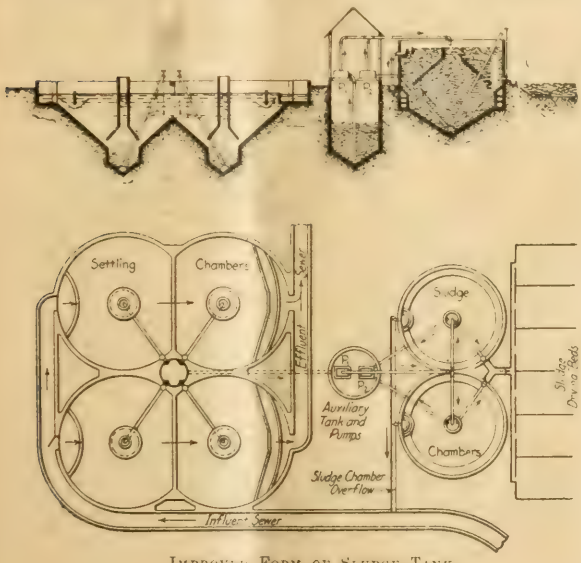
Pudlo.—The filtration of water through leaky railway bridges has engaged the attention of railway engineers for many years. We are informed that the North-Eastern Railway have been experimenting with renderings of Pudloed cement upon two of their railway bridges at Bridlington and Whitby respectively, and that the engineer has expressed his satisfaction with the result.

Separate Sludge Digestion and Improved Mixing in Imhoff Tank.*

By DR. IMHOFF.

The most modern and the most widely used methods of sewage treatment show an unmistakable tendency to keep the sewage as fresh as possible, to remove the settled sludge from the settling chamber as rapidly as possible, and to cause this sludge subsequently to undergo a process of anaerobic decomposition in a separate chamber. Imhoff tanks are included in this category. The characteristic of an Imhoff tank is that it is composed of a sludge chamber situated under a settling chamber and so connected with the settling chamber by means of a slot as to permit the settling sludge to slide by gravity from the latter into the former, but so as to prevent any flow of sewage through the sludge chamber.

Objection has sometimes been made to Imhoff tanks on the ground that they necessitate two-storied construction, with its attendant difficulties and expense; and attempts have frequently been made to secure the advantages of Imhoff tanks by placing a sedimentation chamber and a sludge-digestion chamber side by side and then pumping the sludge from the former to the latter as a substitute for the gravity flow in Imhoff tanks. However, many difficulties have developed in the course of these attempts, and it is only recently that these difficulties have been obviated.



IMPROVED FORM OF SLUDGE TANK.

SEPARATE SLUDGE DIGESTION.

In the following discussion, apparatus will be described in which the settling chamber and the sludge-digestion chamber are situated side by side and in which it has been found possible both to keep the sewage fresh and to digest the sludge satisfactorily. All apparatus herein described has been constructed and operated on a practical basis in large municipal sewage plants.

The difficulties which have developed in connection with separate sludge digestion are twofold. They relate to the settling chamber and also to the sludge chamber. The problem in connection with the settling chamber is to remove the sludge from it so frequently and so completely as to insure the maintenance of the sewage in a fresh condition. The older type of plant, in which it is necessary to pump out the total water content of the tank each time sludge is removed, will not be discussed here, as this type of plant is not practical. There is only one other form of plant, and in this form the sludge is removed from the tank without discharging the supernatant liquid. The invert of the sedimentation chamber in designs of this kind must be divided into one or more sumps and a sludge-discharge pipe inserted for each sump so that its lower end reaches to the lowest end of the sump. In the operation of plants of this kind it has developed that the sludge cannot all be removed, but that a considerable portion always remains sticking to the walls. In addition, the inevitable funnelling of the sludge in the sump and the consequent discharge of water with the sludge unnecessarily increase the water content of the latter. The residue of sludge which remains in the sedimentation chamber decomposes, gasifies, floats to the surface, and may thus escape with the effluent.

In the accompanying drawing these difficulties have been avoided by the addition of a hood above each sludge sump. The presence of this hood makes it unnecessary to remove all of the sludge at each operation. Even if the remaining sludge should become septic and float it would be confined to the hood and not endanger the effluent. In effect, it would rise to the surface inside the hood, sooner or later give up its gases, and finally sink again, to be removed with the next sludge discharge. Inasmuch as the sludge is never completely removed, it is impossible for water to break through and escape with the discharging sludge.

In addition to this device, which makes it possible to obtain sludge of relatively low moisture content and simultaneously to keep the sewage fresh, there are also a number of other new features included in the drawing. The tank is cylindrical and its invert is conical. Such a design permits the same slope at all points of the invert and causes the sludge to slide uniformly toward the lowest point. Statically, also, this form of tank is the best. It makes possible the use of thinner reinforced-concrete walls than any other design, since it is exactly adapted to receive the stresses produced by the upward pressure of ground water and by the radial pressure of the liquid contents.

FLOW HORIZONTAL.

The direction of sewage flow in the tank is horizontal and not downward and upward, as has hitherto been usual with circular tanks. The downward and upward direction of flow has been found to be inferior from the standpoint of percentage removal of settleable solids. Nor does the sewage flow from centre to circumference as in the past. It flows from one side of the tank to the other, so as to produce a longer flow line and at the same time to eliminate a considerable portion of the excessively long circumferential effluent channel. This form of tank therefore approaches most nearly an ideal design from the three standpoints of statics, sewage sedimentation and sludge removal. The drawing shows two tanks combined as one.

The decomposition of sewage sludge in separate chambers was first believed possible in shallow, flat-bottomed tanks. It was thought that it would simply be necessary to pump the sludge into these tanks and allow it to remain until sufficiently decomposed. All attempts of this kind have, so far as I am aware, failed. The sludge in these tanks produces unpleasant odours, and takes a long time to decompose to anything like a condition in which it can be dried without nuisance.

A properly designed sludge-digestion plant should be one in which the sludge takes only a few months to decompose to a condition in which it dries easily and without producing a nuisance. Neither should

*From *Engineering Record.*

any foul odours be produced in such a plant during the process of decomposition. These requirements have been satisfied in Imhoff tanks, and it seems logical, therefore, to imitate artificially in the separate digestion process the conditions obtaining in an Imhoff tank. The design shown in the drawing is the result of a successful attempt to imitate these conditions.

PROMOTE GROWTH OF ORGANISMS.

In order to achieve odourless decomposition it is necessary to promote the growth of the proper organisms and to maintain the conditions necessary for their existence. With this in mind it seems logical to *feed* the sludge that is properly decomposing, and to *inoculate* the fresh sludge with the proper organisms as soon as it arrives. This inoculation is necessary so that the fresh sludge may not have an opportunity of entering into improper decomposition—for example, acid decomposition. Both of these conditions may be fulfilled by the same device. In short, it is merely necessary to *mix* the fresh and decomposed sludge in accordance with certain rules. Such mixing may be most simply done in closed pipes.

In the drawing it will be seen that the fresh sludge flows by gravity from the settling chamber to an auxiliary sludge chamber. This chamber is provided with a pump P_1. It will be observed also that a pipe leads from the bottom of the sludge-digestion tank to a second pump P_2, also located above the auxiliary chamber. In operation the two pumps simultaneously force both fresh and decomposed sludge into a common sludge pipe. This manner of operation results in immediate mixture of fresh and decomposed sludge in any desired proportion, and in the discharge of this mixture into the digestion chamber. Further mixing occurs in the digestion chamber itself by means of the rising gas bubbles. The small gas bubbles which develop as a result of the decomposition process remain sticking in part to the sludge particles, and by increasing in size progressively reduce the mass specific gravity of the combined sludge particle and gas bubble until it is less than that of water. At this time, of course, the two rise to the surface of the tank.

If the action taking place on the inside of the digestion chamber could be observed it would be seen that large and small particles of sludge are continuously rising to the surface of the tank, there giving up their gas bubbles, and, once more heavier than water, sinking back to the sludge layer at the bottom of the tank. This natural mixing, however, is insufficient. If it alone be depended upon it will be found that in a short time a scum layer will develop and will grow thicker and thicker. When, after this begins to take place, gas-laden sludge particles rise as described, they are not able to release themselves from their gas bubbles because of this impenetrable mat on the surface, but instead become imprisoned in it. Little motion or mixing takes place in this scum layer, and for this reason it will be found that the decomposition taking place in the scum layer will be relatively feeble—may, indeed, be an undesirable or nuisance-producing kind of decomposition. This evil may be artificially avoided by constructing in the digestion chamber a partition or apron which operates in a similar manner to the partition walls in Imhoff tanks. With this apron in place the gas bubbles are deflected to a definite point or points in the tank surface. In the drawing this point is shown as the middle of the tank. In consequence of this provision there will be no rising gas bubbles at any other part of the tank surface, and any floating sludge there, not being continually buoyed up afresh by rising gas bubbles, will gradually become heavier than water and sink to the bottom. In the middle of the tank, however, to which point all of the gas bubbles are being deflected, the combined stirring action of the gas bubbles is so strong as continuously to break up the scum layer.

It seems logical also to make this part of the tank surface the part at which the fresh sludge is introduced, because at this point exists the best opportunity for the fresh sludge to become mixed most quickly and most uniformly with the contents of the tank.

UNIFORM TEMPERATURE DESIRABLE.

Since the decomposition of the sludge depends upon living organisms, it is necessary to maintain the temperature as uniform as possible. In Imhoff tanks this occurs naturally by virtue of the depth of the tank and because of the fact that the sewage which flows through the settling chamber above the sludge chamber is fairly uniformly warm. Separate sludge digestion chambers built above ground may develop difficulties, because it may not be possible without artificial aid to prevent harmful fluctuations of temperature. Artificial means may therefore in this case be of advantage. In the drawing are shown circumferential conduits on the inside of the tank. These may be operated either with warm water supplied from a central heating plant or simply with sewage.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Was it not rather startling to read lately that a Dover councillor said he had a chemical that would kill a rat at 20 yds.? Was it surprising that the council at once appointed this gentleman municipal rat-catcher, and is it not very disappointing to read that he declined the honour? Should not the rats of Dover wag their tails with joy to feel that such a dangerous "Pied Piper of Hamelin" has not taken office?

* * * *

Has the evolution of the slum been caused by devolution, as recently claimed by Mr. Cheverton Brown, of Hull, the president of the National Federation of Property Owners? Is it a fact, as stated by him, that "all slum property, when new, was decent property," and that it became bad through occupation by the "slummer"? Is there not something to be said in favour of his suggestion that such idle, filthy and verminous people are a danger to the State, and should be dealt with accordingly, instead of proceeding against the landlord, who is really not responsible? Would it not meet Mr. Brown's objections if municipal authorities would only provide housing accommodation for the real slummer and leave private enterprise to find it for the more respectable citizens?

* * * *

Why should we not produce all our power near the coalpits, and distribute it electrically, as proposed by Mr. Ferranti in his presidential address to the Institution of Electrical Engineers? Is not such a scheme too enormous for private enterprise, and can the Government take it up at present with all their other "activities"?

* * * *

Was not the paper on the security of tenure and defence of surveyors which was presented by Mr. J. H. Drew at the annual meeting of the Institution of Municipal and County Engineers an admirable digest of this important question? Is it not to be hoped that the council of the institution will take up the matter afresh, and not rest satisfied till they have induced the President of the Local Government Board to promise some legislation on the subject? Is there any ground for the suggestion sometimes made that, owing to the fact that most members of the council represent the larger and more important municipalities, they do not themselves realise the position of their less fortunate brethren? Who is to be the Don Quixote who will take up the cudgels on behalf of the surveyors, who are now unquestionably in a precarious position?

* * * *

Is there not a considerable point of importance which is sometimes lost sight of in discussing questions of town planning in some of our coal-mining districts—namely, how long will the coal which is being "gotten" last, and what is to happen if mines in these localities have to be closed down? Are there not existing in Yorkshire and elsewhere districts in which there are rows of empty cottages owing to this cause? Is it not well known that in these derelict districts a house that cost at least £150 to build can now be bought for £5, because no occupiers can be found?

* * * *

Should it not be a slight warning to some of the architectural enthusiasts on town planning when it is considered that some of the most beautiful foreign cities are not quite so sanitary as they should be? Who was it who once wrote the following lines, in the style of Pope?—

> "What though the roads be wide, the buildings tall—
> Neglected, ill-kept streets will spoil it all."

Is there not something behind beauty which is of even greater importance?

WALLASEY'S NEW TOWN HALL.

The new town hall at Wallasey, which has been under construction for the past two years, was informally opened recently for inspection by the public prior to its being handed over to the Government authorities for temporary use as a hospital.

The contract for the building was let in May, 1914, and the structure would have been completed by June last but for the war. At the latter end of 1915 it was proposed to close down the building and postpone its completion until the conclusion of hostilities; but when it became known that the War Department required further hospital accommodation, the building was offered to them, rent free, and was gladly accepted by them. During the past few months the contractors have been busily engaged in carrying out such work in the building as is required by the military authorities for hospital purposes. It has been found to be easily adaptable, and makes an excellent hospital, with accommodation for about 350 beds. The completion of a large portion of the decorative plaster-

From photo by] WALLASEY TOWN HALL. *[Stewart Bale, Liverpool.*

work, marble pavings, oak panelling, doors, &c., has been omitted for the present, and will not be proceeded with until after the war.

The new building, which throughout is in the Renaissance style, has frontages to the Promenade, Brighton-street and Queen's-road, and stands on a site of over two acres midway between the Seacombe and Egremont ferries. The building is set back about 140 ft. from the Promenade, and is approached from the latter by a series of wide steps, with terraces and grass banks. On the Brighton-street frontage, where the principal entrance is placed, a square is formed which is laid out with two large grass plots with spacious footpaths and carriage-drives around. The frontage to Queen's-road has been well set back from the street, giving such ample space all round the building as few town halls enjoy. The building has frontages of 156 ft. to Brighton-street and the Promenade, and 176 ft. to Queen's-road and the south side. It has been planned with a considerable amount of spare accommodation, which will be occupied as the various departments require further space. It has also been arranged that an additional story can be added on the north, south and east fronts without in any way detracting from the appearance of the building.

The principal entrance, placed in the centre of the Brighton-street front, gives direct access to the treasurer's department to the right and leads, by means of a wide, vaulted corridor, to the principal staircase hall, from the centre of which rises the grand staircase. The borough treasurer's offices occupy half the Brighton-street frontage and the whole of the south wing of the building on the ground floor. The Education Department is placed in the centre of the river frontage, and the Medical Officer's Department along the remainder of this frontage and the greater part of the wing facing Queen's-road. The rest of the frontage towards Queen's-road is occupied by a large entrance hall and staircases, which give access to the public hall on the first floor. The staircases and entrances are so planned that the public hall may be used quite independently of the rest of the building. In connection with the public hall an additional entrance has been provided facing the square.

The large public hall occupies the whole of the frontage to the square at the first-floor level. The hall is 87 ft. long by 50 ft. wide by 36 ft. high, opening out at the gallery level to a length of 126 ft. The ceiling of the hall takes the form of an elliptical barrel vault, which is richly panelled and decorated in fibrous plaster. The walls are to be panelled in oak to the height of the window sills. Accommodation is provided for about 1,200 persons, and includes gallery, platform and orchestra. At the head of the grand staircase on the first floor a large landing gives a further means of access to the public hall through a circular reception room. To the right and left of the landing wide corridors lead to the town clerk's departments on the one hand, and the supper room, committee rooms, and Mayor's parlour on the other. These rooms, together with the public hall, form a fine suite of reception rooms admirably suited for entertainments and social functions of all kinds.

The council chamber, which faces the river and is approached from the grand staircase, occupies a central position on the river frontage. It is reached through an ante-room having vaulted ceiling and oak-panelled walls. The chamber is a fine apartment, 50 ft. long by 34 ft. wide by 24 ft. high, and capable

of seating sixty councillors. The ceiling is richly treated in panelled fibrous plaster. The walls, like those of the grand staircase and corridors, will be finished in French stuc of a warm cream colour. Oak fluted columns and pilasters and an oak panelled dado will complete the decoration.

On the second floor the borough engineer's department is placed, a number of spare offices occupying the remainder of the space. The caretaker's quarters are on the third floor, and in connection with them dining accommodation for the convenience of the staff is provided.

Under the greater portion of the building basement accommodation has been provided. Along the north side various rooms and offices in connection with the gas department are placed, including a gas lecture room, where instruction will be given in cooking by means of gas. A large number of store-rooms is provided for the various departments, and a bicycle room, reached by means of a sloping way from the back roadway. On this floor also the boiler-house and vacuum cleaning plant is placed.

The architects for the new building were Messrs. Briggs, Wolstenholme & Thornely, of Liverpool.

The general contractors were Messrs. William Moss & Sons, Limited, Loughborough, and sub-contracts were let as follows:—

Constructional steel work: Messrs. John Booth & Sons, Bolton.

Heating and ventilation: Messrs. Saunders & Taylor, Limited, Manchester.

Lifts: Messrs. Waygood & Sons, London and Liverpool.

Sanitary fittings: Messrs. Oates & Green, Limited, Halifax.

Iron escape staircases: Messrs. Hayward Bros., Limited, London.

Patent glazing: Messrs Helliwell & Company, Limited, Brighouse.

Locks and ironmongery: Mr. James Gibbons, Wolverhampton.

Safes: Messrs. Milner's Safe Company, Limited, Liverpool.

Cooking apparatus: Messrs. John Wright & Company, Liverpool.

Cast concrete: Messrs. The Shap Granite Company, Shap.

Glazing: Messrs. J. G. Nicholls, Limited, Liverpool.

Asphalting to roofs, &c.: Messrs. La Brea Asphalt Company, Limited, Birmingham.

Concrete flagging: North Wales Paving Company, Penmaenmawr.

Vacuum cleaning plant: Fanvac Company, Liverpool.

Rainwater heads: Messrs. Walter Macfarlane & Company, Limited, Glasgow.

Door springs: Messrs. D. Elliott & Company, Manchester.

Fire appliances: Messrs. George Angus & Company, Limited, Liverpool.

The whole of the work has been carried out under the supervision of Mr. G. J. A. Burrows, of Wallasey, who has acted as clerk of the works.

Replanning of Dublin.—The adjudicators in the Marquis of Aberdeen's competition—viz., Professor Patrick Geddes, of Edinburgh; Mr. C. J. McCarthy, F.R.I.A.I., city architect of Dublin; and Dr. John Nolen, of Cambridge, Mass.—have completed their examination of the designs. The prize has been awarded to the design submitted by Professor Patrick Abercrombie, of the Department of Civic Design, Liverpool, and Messrs. Sydney A. and Arthur J. Kelly, surveyors, of Liverpool. Honourable mention has been given to the designs submitted by Messrs. Ashbee and Chettle (C. R. Ashbee, F.R.I.B.A., and George H. Chettle), architects, of Chelsea, S.W.; by Messrs. J. M. L. Bogle, B.E., city engineer's office, Liverpool; Arthur W. Panton, M.A., Assoc.M.Inst.C.E., Clontarf, Dublin; H. O. Burroughs, B.A., University School of Architecture, Liverpool; and O. Newbold, certificated architect, Liverpool; by Messrs. Kaye-Parry and Ross (W. Kaye-Parry, M.A., F.R.I.B.A., M.Inst.C.E., and George Murray Ross, M.A., B.I.A., M.Inst.C.E.I.), civil engineers, architects, and estate surveyors, 48 Kildare-street, Dublin; and by Mr. Frank A. Cushing Smith, B.S., M.L.A., University Club, Urbana, Illinois. It is hoped to arrange for an exhibition of the designs in Dublin at an early date.

WORCESTERSHIRE ROADS.

By C. F. Gettings, M.Inst.C.E., County Surveyor.

[The following is extracted from Mr. Gettings' report on the main roads and county bridges for the year ended March 31st last.]

The estimate for the year was £100,735, but at a later date, in consequence of the special conditions existing at that time owing to shortage of labour and difficulties in obtaining material, the committee recommended a reduction of £14,901, which made the revised estimate for the year £85,834. This was approved by the county council in September. The greater part of this reduction was abstracted from the estimate provided for under the Road Board scheme. The total expenditure was £76,262, which left an unexpended balance of £9,572; the greater portion of the latter sum was for work included in the ordinary maintenance estimate for the various districts. Unfortunately, this was due to our being unable to obtain materials and to the serious depletion of the staff. As compared with the approved estimate (which was considered to be a reasonable one) it will be seen that the expenditure for this particular year is £24,473 less than was originally provided. The estimate for the current year was made on the basis of the actual expenditure of last year. It must be quite evident that this principle cannot be continued without serious results, especially as the heavy motor traffic continues to increase, and it is already quite perceptible on many of the roads which have been starved. Although I do not wish to enlarge unduly upon this point, I consider it my duty to call the attention of the committee to the serious position which will have to be faced in the near future.

Last year was one of the worst as regards maintenance of roads that has been experienced for many years, as the early part of the summer was very wet, so that the roads did not have a chance to recover, and, coupled with this we experienced a record snowfall, which in many cases caused the traffic to be diverted into one channel for considerable periods.

MOTOR-'BUS TRAFFIC.

The motor-'bus traffic has continued to increase, some new services being opened and a number of the services already scheduled in previous reports being extended. There are now services over 216 miles of main roads in the county, which is exclusive of roads maintained by borough or urban district councils. As I pointed out in my last annual report, the whole of these services have been put into operation since September, 1912.

The Local Government (Emergency Provisions) Act, 1916, which includes special clauses relating to the establishment of motor-'bus routes, is now under your consideration. It appears that this Act was brought about more to prevent the immediate extension of motor-'bus services than to establish a principle of contribution towards the upkeep of the roads. Unfortunately, this county has been hit very severely in this direction, and, although it is admitted that the services are a convenience to the public, it is a debatable question as to whether the benefits enjoyed are recouped by the county in an indirect manner. There is no doubt that this traffic is one of the most destructive that has ever been put on to the public highway.

TAR-PAINTING.

About 96 miles of main roads (exclusive of borough and urban areas) were tar-painted, at a cost of about £5,500. Excepting on gradients, the whole width of the roads has been treated, and some 1,004,575 super. yds. were covered. As in previous years, the work was carried out by our own staff. As the committee are aware, I am a strong advocate of tar surfacing where there is a moderate amount of motor traffic, and I am sure the work that has been carried out on the more important roads hitherto has been of material assistance where the motor-'bus services have been established, and I am glad that the committee decided further to extend this work if it could possibly be done during the current year.

URBAN MAIN ROADS.

The borough and urban authorities have maintained their roads fairly satisfactorily considering the circumstances under which we are now working, but in several cases the condition is not what might

The Surveyor
And Municipal and County Engineer.

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be desired. It would not be fair to criticise at the present time, but I hope that considerable improvement will be effected immediately circumstances permit. I still consider that more attention might be given to scavenging, and less to street watering.

ROAD BOARD SCHEMES.

The five years' scheme, commenced in May, 1913, was proceeded with throughout the year, but the rate of progress made was exceedingly slow, as at no time were more than three gangs employed, and latterly only two, and those very small in number. Attention was mainly confined to the Birmingham and Halesowen road (part Mucklow's Hill), Hagley and Halesowen road, Kidderminster and Hagley road and Birmingham and Redditch road, all of which had got into an unsafe condition through the heavy motor traffic, and it was imperative that these sections should be proceeded with immediately. The total length of roads reconstructed under this scheme to March 31st last was approximately 25¼ miles.

[The scheme provides for the strengthening, widening and surfacing with bituminous-bound material of about 53½ miles of main roads, at an estimated cost of £127,000.]

STEAM ROLLING.

The twelve ordinary steam rollers and two patching rollers belonging to the council have been working throughout the year. The ordinary rollers have worked 2,394½ days, and have consolidated 56,618 tons of material, being an average of 23½ tons per day. This average is much lower than previous years, and is due to the fact that the majority of the rollers have been understaffed. The patching rollers have been fully employed and have done very useful work, but it is difficult to give an accurate estimate of the quantity consolidated.

Allowances to Officials on Service.—The question of the allowances paid by Doncaster Corporation to supplement the Army pay of corporation servants who had enlisted has been considered by the council. The council had applied to the Local Government Board for sanction to continue their allowances on the scale originally fixed, and the Local Government Board now replied that where local authorities had applied for sanction to continue allowances above the maximum laid down in the Emergency Provision Act, they would be permitted to do so with the limitation that in no case shall the allowance paid together with the Army pay and separation allowance increase an enlisted employee's income to an amount more than 25 per cent above his pre-war salary.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Wantage R.D.C. (August 22nd. Mr. A. G. Drury).—£3,150 for works of sewerage and sewage disposal at Letcombe Regis and East Hendred. The engineer, Mr. J. W. Harris, gave details of the proposed scheme, and at the close of the inquiry the inspector suggested that the work to the council should endeavour to get the owners of various properties to disconnect their sewage from the stream.

APPLICATIONS FOR LOANS.

Bradford T.C. £3,700 for electric wagons.

Inishowen (Donegal) R.D.C.—£1,000 for the repair of flood damage.

Rotherham R.D.C. £1,370, excess cost of water supply works.

LOANS SANCTIONED.

Aylesbury U.D.C. £600 for extending the battery at the electricity works.

Rawtenstall T.C. £2,216 for electric cables, transformers, and switchgear.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
5. **Penmaenmawr.** For laying out a cemetery (Mr. P. M. Crosthwaite)	—
7. **Shardlow.** For works of sewage disposal (Mr. P. M. Crosthwaite)	3,600

RE-USE OF OLD WOOD BLOCKS.

The city surveyor at Gloucester, Mr. E. W. A. Carter, would be greatly obliged if any engineer who has had experience of taking up, redressing and relaying wood blocks would send him particulars.

Birmingham Drainage Board.—It has been decided by the Birmingham Tame and Rea District Drainage Board to apply to the Local Government Board for sanction to a loan of £12,250 for the purchase of the freehold interest in about 123 acres of land at Erdington.

Prisoners for Sewage Works.—The Birmingham, Tame and Rea District Drainage Board are applying to the War Office for permission to employ German prisoners on their sewage works. If the application is granted, the men will be engaged on navvying work. It has been found impossible to obtain other labour.

Timber, Plywood, and Woodwork.—In next week's issue there will appear a page advertisement which will give various particulars of timber, plywood, and woodwork which Messrs. C. Jennings & Co. have for sale. The page will be found useful for reference by all who make use of such goods. The firm's head office is at Pennywell-road, Bristol, but they have branches at Leicester, Porthcawl, and stocks warehoused at Swansea, Hull, Pembroke Dock, Neyland, Newcastle, Manchester, Liverpool, and elsewhere.

Sewage Farm Managers and Military Service.—At the last meeting of Houghton-le-Spring Rural District Council the Sedgeletch Sewage Farm Committee reported that the clerk had again appealed to the County Tribunal for the conditional exemption of the farm manager, and had failed. The committee recommended that the clerk should advertise for a temporary manager at a weekly wage of £2. Mr. W. H. Handley said it seemed somewhat strange that, while they were being asked to do all they could to increase the food supply of the country, the authorities would not allow this man conditional exemption. On the council's farm he had to cultivate 10,000 celeries and 60,000 Savoy cabbages. He had 20,000 cabbages and 50,000 onions to plant. There were 350,000 cauliflowers ready for market. They had 3 acres of beet, 1 acre of leeks, 2 acres of rhubarb, 1 acre of turnips, ½ acre of rye grass, and a considerable quantity of parsnips and other produce. According to instructions sent to tribunals he understood that market gardeners were allowed to retain one man to 3 acres. Their farm had 23 acres, yet exemption was not granted to this man with all these hundreds of thousands of plants under his control.

Sanitation Problems in Civil Areas near Temporary Military Camps.*

By G. BERTRAM HARTFREE, F.S.I., ASSOC.M.INST.C.E.I., M.R.SAN.I. (Member), Surveyor to the Urban District Council, Alton.

In apologising for presenting this paper, the author's excuse is the fact that although sanitation difficulties met with in temporary camps, including temporary increase of size of permanent camps, has been dealt with by several authors, to the best of his belief those caused by the resultant increase of civilians in areas near camps have not formed a subject for consideration by any professional body previously.

CAUSE AND EFFECT.

Either the number of soldiers in camp A has been multiplied B times, or where formerly there was no camp suddenly there came into being something similar to that described by a well-known author as "Mudsplosh" camp; covering what was formerly dry turf, wild yellow gorse, and fragrant heather. The effect in either case is an influx of civilians, either relations who wish to be near the soldier husbands, fathers, or sons; or those seeking employment, engaged in business, and many more particularly out to make money. Under this last-named class is included all grades, from the established business man extending his scope of work, and descending stage by stage to the primitive form of individual known generally as a gipsy, but who, for reasons better known to himself, prefers to be called a "traveller."

HOUSING CONDITIONS.

It is doubtful whether more variable dwellings may be described in any other vicinity in the country than those seen during a five minutes' walk in the neighbourhood of a camp increased X times for the duration of the war. First may be seen what was formerly an isolated country residence, now hedged in by camp on the one side, and by brick, wood, and other civilian dwellings on the other sides. Near-by is a wooden erection with a tiled roof, and from the large lettered sign-board it may easily be discovered as the local branch of a London bank. Next occurs the inevitable "cinema," occasionally brick built, sometimes iron or wood, and as a last resort, canvas. From here one leads on to the "High-street," where are brick and stone erections planned on town lines and intended as permanencies, and adjoining wood or iron buildings, either taken from a stock design or built on stage by stage until the final result is a homogeneous mass of wood, iron and space.

Near-by are found the working-class dwellings, the design and construction of which is still more variable. Occasionally brick-built cottages are seen, cottages originally intended for occupation as such. Again, bungalows of the type commonly known as week-end bungalows are discovered, situate on possibly a sufficiency, more generally an insufficiency, of land; probably all that was required for the original purpose, but as the buildings are now let off as two-room tenements, the garden space is considerably restricted. Other types of residences include the gaily painted galvanised villa in the catalogue of some enterprising manufacturer, with a descending scale of iron buildings, from the home-designed house, constructed of second-hand corrugated-iron sheets, to the final stage of the gipsy habitation, armoured with flattened bully-beef tins, petrol cans, and such other similar iron the proud owner is able to "find." The more temporary habitations include, higher on the scale, the condemned army bell-tent, which is marked by broad arrows in pairs with points touching. An examination of these habitations will prove conclusively that the Army Stores Condemnation Boards are in no way wasteful. At the lower end of the scale may be seen the gipsy wigwam made from a large and varied assortment of materials; from the outside picturesque, the inside smoky, draughty, and to the venturesome who wish to investigate further, well occupied, and also strong in an olfactory sense.

OVERCROWDING.

The evil of overcrowding cannot be entirely removed, but at times may be reduced, as in instances where four persons occupy a room with 600 ft. of air space, while the "sacred" parlour is kept at all times as a sanctuary for the usual glass dome, sheltering gaudy artificial fruits or flowers; photographs of relatives in constrained postures, and the other appurtenant parts of such parlours. Improvement of overcrowding evils is practically limited to insistence upon uniform occupation of all suitable rooms, the removal, by tact or otherwise, of those whose presence in the area is undesirable, supported by education of the occupiers in the principles of natural lighting and ventilation.

REFUSE.

When the cottager in rural areas does not keep a pig, the usual practice is to dispose of house refuse by stacking in a heap away from dwellings, and allowing it to rot for manurial use, or digging direct into the ground. But in temporary congested areas cases often arise where the ratio of garden per tenement is too restricted to permit effective disposal in this manner, and no public system of scavenging existed in the pre-war period—in fact, it was unnecessary. A system even now may not be required for the greater part of the community, and if generally acceptable, other conditions arising from the war prevent its adoption. Many cases are found where offensive "dumps" exist, which might be prevented by the cottagers carefully sifting their ashes, burning the cinders, using the residue for home path construction. Ofttimes a quagmire footpath or backyard could be remedied by judicious use of the ashes which are generally intermixed in a heap with evil-smelling liquids and refuse. Too little attention is paid to individual effort in sorting house refuse; much that is allowed to fester and rot could be dried and burnt in the kitchen range. Excellent backyards have been made on foundations of old tins and broken crockery, with a surface of ashes. On the subject of home destruction of refuse, there appears an inventive necessity for an economical kitchen range to burn refuse; but assuming such to be discovered, as a race we are far too conservative to adopt it generally.

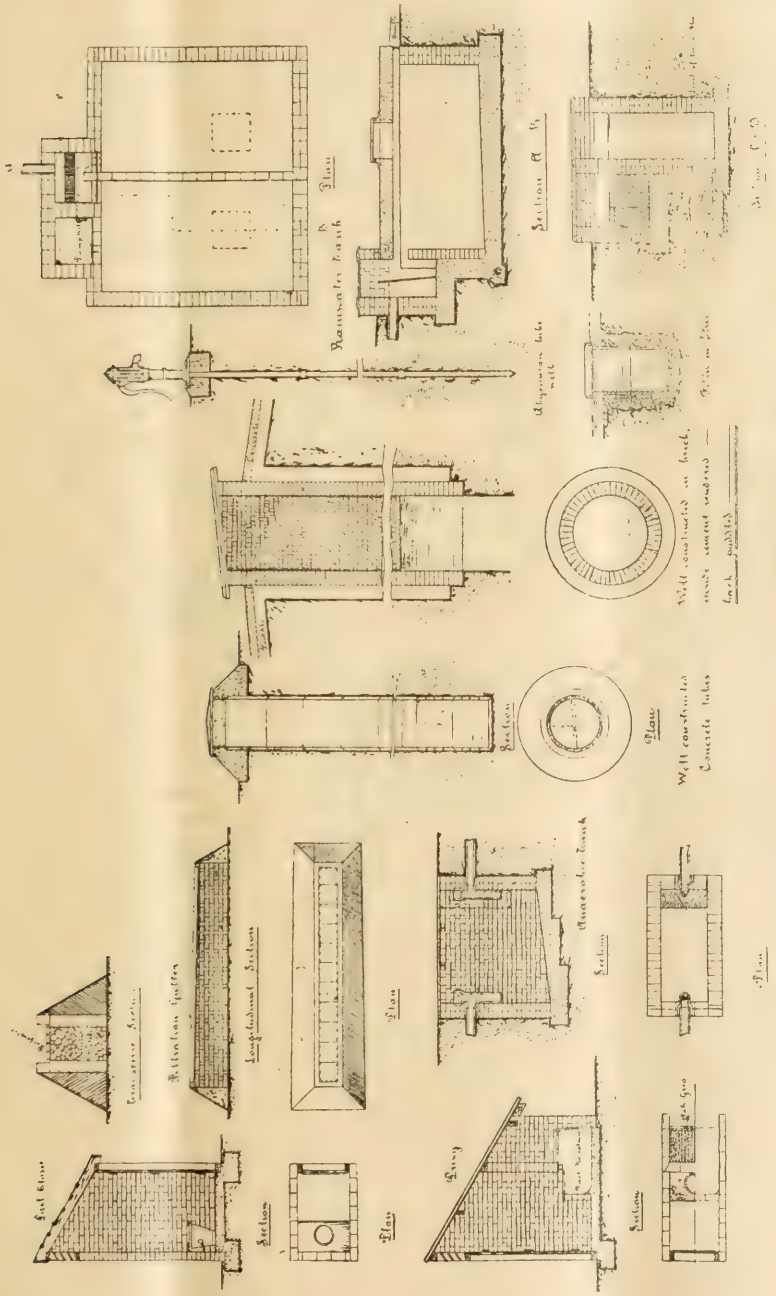
CLOSETS.

The areas under consideration are without a water-borne system of sewage disposal; in peace times probably the requirements of the community did not warrant such. A majority of the dwellings may still be well served by ordinary earth disposal, but others are very problematical. A common fault that can be remedied is the use, or abuse, of the privy or earth-closet as a receptacle for slops, &c. There is great ignorance or indifference shown by the average cottager to the principles of dry earth disposal. When earth is the deodoriser adopted, ofttimes it is dug and used wet or damp; far more suitable is the powdery top-soil. If not required for other purposes, ashes may be used with success, and the illustrations show a type of privy with iron bars at the back, upon which the residue from grates may be thrown, the cinders arrested by the bars, while the ashes fall upon the contents of the receptacle. Possibly the best material for use with this system is peat moss litter; the author has known instances where the contents of the pails have been emptied in a dry place; after a few months all traces of the excreta had disappeared, and the moss litter could again be used. A successful earth system requires a naturally dried deodoriser, full of micro-organisms of a useful character that will render the soil harmless and reduce it to its original chemical component parts. Artificially dried earths may be advantageous as compared with damp substances, but the procedure kills the bacteria that are required to perform the work of sewage disposal.

Should a self-contained home water-borne system be adopted, there is the option of either a cesspool or miniature sewage disposal works. The former may consist of a watertight receptacle with or without an overflow; or what is practically the same in principle as the latter, a single cesspool that is not

* Paper submitted at the annual meeting of the Institution of Municipal and County Engineers at Blackpool.

watertight. The objection to the former is the trouble of emptying. It must be remembered that these are not areas containing a preponderance of villas with every facility for the entry of vacuum cesspool emptying carts. To sum up, should there be sufficient land for disposal purposes, possibly an anaërobic tank with either subsequently land surface



Proposals for Improvement of Sanitation around Camps.

treatment or some form of bacteria system would be successful; or a watertight cesspool, the contents of which may be distributed on the surface of the land near by, may be preferable. There must be great risk in any form of underground soakage whenever the water supply is from local wells, and there is no doubt that in such cases the dry earth system is preferable, unless purification can be finally completed on the surface of the ground.

Disposal of Liquid Waste.

This is a serious problem, and is intensified by cottagers being permitted to wash soldiers' clothes in their own houses. This, in the absence of a water-borne system, results with low-lying areas naturally waterlogged, in a series of gardens closely akin to the paddy fields of the East, and lined with innumerable foul-smelling ditches. There are two alternatives for disposal, the old-fashioned cesspool, which either must be emptied or its contents permitted to soak into water supplies, or the adoption

of filtration gutters. The latter were the idea of Dr. Poore in India, and with a sufficiency of area properly applied should enable the disposal of all liquid sewage without bad effects. The principle entails the erection of parallel walls in brick or stone, laid pigeon-holed, which support perforated tiles, and surmounted by a coping; under the tiles and between the walls the space is filled with selected rubble, the outside is banked with earth, in which plants with an affinity for water are planted. Given suitable vegetation, Nature will solve the problem of liquid disposal, and if no other plant be required or obtainable, water lilies, in addition to absorbing liquids, will give a pretty and rustic effect.

WATER SUPPLY.

Common sources of water supply in rural areas are from local shallow wells, or rain-water off roofs. The former are generally designed by the local builder on lines adopted from his grandsire, and consist of open brickwork in a soil which, if not already polluted, will in all probability become saturated with filth at an early date. Very rarely does it occur to him that there are two "Q's" to consider in water supply—quality as well as quantity. Often a safe local supply may be obtained by backing the brickwork with clay puddle, and rendering the interior with a coating of cement, or a far sounder work could be made by substituting for rectangular shapes purpose-made bricks radiating to the diameter of well. Generally the objections to this system, even when common bricks are used, is the expense attached, and a far cheaper and equally effective arrangement is the use of purpose-made concrete tubes or stoneware pipes, while an alternative is a driven tube on the principle of the Abyssinian well. Stream supplies are subject to pollution, and a safer procedure would be sinking stoneware pipes into stream bed, surrounding the sides for a distance of 6 in. to 12 in. with clean hardcore or flint, and placing in the lower section fine washed sand which would be prevented from rising in the "dip-hole" by a sheet of fine-mesh wire gauze securely fixed between the spigot of the upper pipe and the shoulder of socket below.

THE SOLUTION.

Under similar conditions in many cases the solution requires a system of sewerage, a public supply of water, and municipal scavenging of refuse. For the special cases under consideration the objections to the first two (sewerage and water supply) include—cost, and delay in executing works arising from: (*a*) The usual machinery of progression; (*b*) scarcity of labour and materials. Against the last may be set: (*a*) Difficulty of obtaining horses and men; (*b*) the inadvisability of placing a burden upon those less able to bear it, to relieve those who are making large profits, but at the same time directly or indirectly causing special requirements to be necessary. For instance, the proprietor of a café informed the author that he would welcome a complete system of sewerage, water supply, and scavenging, as at that time he was paying 15s. per week, by private agreement, for sanitary services. The café in question consisted of a wooden carcase, the outside covered with galvanised iron, the interior lined with match-boarding. Upon the trade of the premises its yearly value could be placed at over £100; as a building apart from its trade, £20 would be the outside annual value. Many similar instances occur, and to generalise, any system on loan account would benefit the owner of the temporary building, but when normal conditions again arrived would place a heavy burden upon the permanent residents, who in the future probably will not require such conveniences. The author suggests as a present-day solution action strictly local in character. The local authority have ample powers to enforce the provision of sanitary requirements; special conditions require special treatment, and consequently it is suggested that in addition to the formal notices from the council, stating that certain specified conditions are insanitary, there should be established an educational assistance department which, while carefully refraining from prejudicing the position and statutory powers of the local authority, will supply general particulars of suitable construction as well as, when necessary, giving details of the most suitable single or alternative arrangement for particular cases considering geological as well as all other factors. This department would perform educational work, for the greater part of insanitary conditions arise from ignorance or indifference, and the cure for the former is education alone.

An example from recent practice is the following: A well 20 ft. in depth from the ground surface to top of water was found polluted, and the source of pollution could not be removed. It is suggested that the well as a well should be closed, that a false bottom be made in reinforced concrete, the interior of walls rendered in cement, made watertight and used as a storage tank for rain-water. Elementary educational principles upon water supplies include the advantages of driven-tube wells, concrete linings, &c., also the construction of filters to contain sand, polarite or similar substance, for the treatment of suspicious waters that cannot be dealt with in any other manner.

Upon soil disposal there are the alternatives dry earth or water borne, the former either fixed or removable receptacle, the latter either to a watertight cesspool or a miniature disposal works. For liquid disposal the author has seen satisfactory home land irrigation works, failing which there is the filtration channel or the watertight cesspool. Co-operation with the military authorities is required in dealing with the home washing trouble. There appear to be two courses open—either for the Army to provide temporary wash-houses in suitable positions and where waste water may easily be disposed, or supplying "washing" permits only to those houses where suitable disposal arrangements exist.

With respect to the treatment of refuse, there appears considerable need for education upon this subject; it may be burnt in the kitchen range; it can be destroyed in the garden, within a destructor consisting of three bricks upon which several old iron bars are placed, the whole supporting a 12-in. drain pipe, with its outside reinforced by fine wire netting. There is an alternative instead of stacking in heaps—dig holes, well pack the refuse to cause spontaneous combustion, and cover with earth from time to time.

By tact, perseverance and co-operation with all authorities, even if perfection be not attained, a great improvement may be effected.

OXFORDSHIRE MAIN ROADS.

COUNTY SURVEYOR'S REPORT.

The length of the main roads in the county of Oxfordshire is 481·7 miles, and in the past year they were maintained as follows: Urban main roads by district councils, 30·04; rural main roads by county council, 438·64; urban main roads by county council, 13·02. The above figures are exclusive of the length of the roads and approaches to railway bridges belonging to the Great Western Railway Company, for the maintenance of which an annual sum of £243 is paid to the council, and is included in the yearly estimates.

In his annual report, Mr. S. Stallard, the county surveyor, states that the total cost of the urban main roads for the year ending March 31, 1916, was £5,409 4s. After deducting the sum of £11 10s. received from the Great Western Railway Company for bridge roads, the nett cost to the county is £5,97 14s., and gives an average net cost per mile of £127, as compared with £139 the previous year. This reduction is mainly due to the non-completion of repairs during the year in the boroughs of Chipping Norton and Woodstock, owing to the difficulty experienced in obtaining the necessary quantity of material, and to a reduction made at Henley by arrangement with the borough.

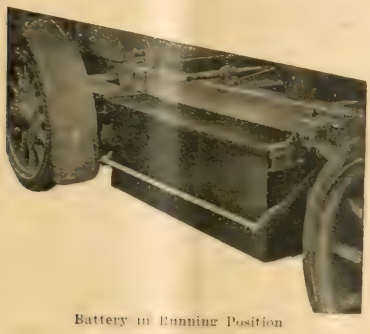
During the past year only necessary repairs to carry on the roads in the borough have been carried out at Henley-on-Thames, and of the total estimate of £370, nearly £200 has been expended on tar-painting existing tarmac surfaces, with very satisfactory results. A portion of the Reading road has been coated with Clee Hill granite, and the Tarmac in Bell-street has been retopped. The same amount of £370 has been allowed for the current year's maintenance, and with the aid of a special grant from the Road Board a considerable area will again be tar-painted.

Under all the circumstances, Mr. Stallard considers that the main roads have been maintained in a very fair condition.

Chimney as a Bedroom.—"The man sleeps on a dirty mattress and the woman sleeps up the chimney," said the surveyor to the Hatfield Rural District Council in complaining at a council meeting of a family who were living under filthy conditions. "Up the chimney?" asked a member. "Yes," said the surveyor. "It is one of those old-fashioned chimneys."

THE "ORWELL" ELECTRIC REFUSE COLLECTING AND TIPPING WAGON.

The restrictions on the use of petrol have already resulted in a very appreciable increase in the demand for vehicles which depend for their operation on other forms of power, and the electrically-driven type is coming into distinct favour, not only among traders, but with not a few officials of local authorities who



Battery in Running Position

Battery Pulled Out for Examination

previously had regarded it with something akin to distrust.

For work involving frequent stoppages the electric vehicle is now generally admitted to be particularly suitable, and in no direction probably can it be employed with greater advantage than in the collection of refuse.

In the 2-ton "Orwell" electric refuse collecting and tipping wagon, illustrated herewith, the efficiency of the combination of the modern storage battery, the motors and the simple mechanical transmission is very high, the makers claiming that from 60 to 70 per cent of the energy put into the battery is applied to the road wheels. The chassis includes a number of special features conducive to long life. For instance, the control of the motors has been designed to give exceptionally gradual starting. The front wheels are pivoted on inclined swivel axles in such a manner as to reduce the stresses on the front tyres to a minimum. Furthermore, the front-wheel drive, which is used on all "Orwell" vehicles up to and including 2½ tons' capacity, greatly reduces the tendency to skid, and thus eliminates one of the causes of tyre deterioration. For these reasons the "Orwell" is very light on its tyres.

As regards the battery, this is slung under the chassis in two boxes, each of which is arranged to slide sideways by pulling a handle-bar. The operation of raising the handle-bar lifts the battery box a fraction of an inch, throwing its weight on to rollers. By pulling the handle the battery slides out easily, and is readily accessible for examination. When the boxes are pushed back into position, the handle-bars are dropped, releasing the weight from the rollers and locking the battery in position.

The selling agents for "Orwell" vehicles, which are built by Messrs. Ransomes Sims & Jefferies, Limited, Ipswich, are Messrs. Mossay & Company, Queen Anne's-chambers, Tothill-street, Westminster.

2-ton "Orwell" Electric Refuse Collecting and Tipping Wagon.

REPAIRS TO BRICK CHIMNEY SHAFTS.

STRENGTHENING BY REINFORCED CONCRETE.

An interesting account of repairs to a dangerously-cracked brick chimney shaft, 150 ft. in height, which successfully transformed it to all external appearances into a concrete chimney, is given in a recent issue of our American contemporary *Engineering Record*. A reinforced concrete shell was built around the old brickwork, using the latter as interior forms and galvanised steel as exterior forms, without interrupting the operation of the plant. The total cost of the work was about one-half the original cost of the brick chimney.

A concrete casing 10 in. thick was placed around the base for a height of 37 ft. The brick was used as an inside form and the outer forms were of wood. Above the square base a circular metal form of No. 8 galvanised steel was used. It had a height of 42 in., tapered and this height was poured each day the weather permitted. All work was done while the chimney was in use during the past winter, starting in November, 1915. On the tapered shaft the concrete is 8 in. thick at the bottom and 6 in. thick at the top. The horizontal bands employed for reinforcement consist of ½-in. bars, spaced 24 in. apart.

Scottish Municipal Forestry.—Tain Town Council have sold the standing timber on their estate of Culpleasant for £2,000 to an Inverness firm, who have been allowed eighteen months to clear it off.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

HOUSING AND TOWN PLANNING.

Birkenhead T.C.—The medical officer of health, Dr. R. Sydney Marsden, in his annual report, lays emphasis on the importance of the housing of the working classes. "I do not think," he states, "that the demand will be met in the future by private enterprise, but will have to be provided by the corporation, and I estimate that at least 1,000 houses will have to be provided especially to meet the call for houses at low rents, of from 3s. to 5s. per week."

Stirling T.C.—A committee has been authorised to consider the question of a housing scheme to come into operation after the war.

MOTOR TRANSPORT.

Bacup T.C.—The first motor fire engine acquired by the corporation has been received and duly tested, the tests proving quite satisfactory. The cost of the engine was £1,100.

Blackpool T.C.—The cleansing department have purchased a second electric water sprinkler at a cost of about £1,000, and outside the town hall a test was carried out in the presence of the members of the committee. The committee discussed what should be done with the vehicles in the winter, and it was decided to have a wagon body made for one and use it for the delivery of coke.

Dover T.C.—The deputy borough engineer has recommended that the collection of refuse be commenced at midnight, thus freeing two of the five Edison electric wagons for other work in the early morning. It is expected that by this means a saving of £500 a year will be effected. The cost of refuse collection by the Edison wagons over a period of eight months works out at 4s. 10·21d. per ton, compared with 6s. 2d. by horses. It is proposed to do street watering and sweeping during the day, a machine-broom being fitted for the latter work. The corporation have given an order for a sixth vehicle.

Erith U.D.C.—A turbine motor fire engine by Messrs. Dennis Brothers, Limited, was delivered recently. It has a 35-40-h.p. engine, and has been subjected to successful tests in speed, hill-climbing, and general capacity.

Hull T.C.—The Health Committee have authorised a sub-committee to purchase a suitable chassis for a motor ambulance.

REFUSE COLLECTION AND DISPOSAL.

Aberdeen T.C.—The estimate of the Cleansing Committee for the ensuing year is £23,000, an increase of £1,063 over that of the past year, due to the high price of provender for horses, and also to the advance in the wages of the men in the carting department. The chairman of the committee, Councillor George, expressed the committee's appreciation of the efforts of Mr. Findlay, the cleansing superintendent, to economise in the department. While the saving he had effected had been considerable, it was, unfortunately, not sufficient to counterbalance the increases which had taken place in certain departments. In this, however, Mr. Findlay had been unable to effect further saving, but he deserved the thanks of the committee for what he had done.

Belfast T.C.—The medical officer of health, Dr. H. W. Baillie, in his annual report states that there are in the city about 82,550 houses, of which 56,847 have been provided with galvanised bins for the reception of house refuse; about 2,000 have other movable receptacles, and 23,703 have ashpits. The refuse is removed from the houses supplied with bins at least once a fortnight, and in some cases weekly. The following is a summary of the removal and disposal of the various forms of refuse from inhabited houses, business premises, &c., during the year: The number of cleansings of ashpits and ashbins amounted to 2,394,901; number of loads removed, 88,278; number of mattresses burned, 1,157; number of dead animals burned, 4,139; manure sent to country by rail, 5,213 tons; refuse burned by destructor, 16,035 loads; refuse sent to tipping grounds, 67,030 loads.

Blackpool T.C.—The Health Committee are proceeding with their scheme for dealing with the offal at the abattoirs, and have now purchased some of the necessary apparatus, which is in process of installation.

Irlam U.D.C.—The provision of refuse destructor plant is being considered.

Surbiton U.D.C.—The surveyor, Mr. H. T. Mather, has reported that it would not prove a remunerative undertaking for the council to make a separate collection of waste paper, and he suggested that if the inhabitants were requested to inform the council when they had sufficient paper to be removed, it could be collected and stored at the depot until there was sufficient to be sold. After some discussion the council resolved that in view of the shortage of labour and other special difficulties existing under the present circumstances no action be taken in this matter.

ROADS AND MATERIALS.

Barnstaple T.C.—The county council having proposed to allow only one-tenth of the cost of scavenging and watering main roads paved with wood blocks, instead of one-third as previously agreed, the town council have approved of a recommendation of the Main Roads Committee to insist upon adherence to the old terms.

Brigg R.D.C.—An application has been made to the Road Board for contributions towards the cost of diverting roads at Gunness and Habrough-road, North Killingholme.

Doncaster R.D.C.—An intimation has been received from the West Riding County Council that they are prepared to make a contribution of £658 towards the cost of the maintenance, repair, and enlargement and improvement of the Great North road and footpath from the Doncaster borough boundary to Rossington Lane—2½ miles in extent—as soon after March 31, 1917, as the county council are satisfied that the road and footpath are being properly maintained.

Dore (Hereford) R.D.C.—With respect to the proposal of the county council to take over the control of the roads, this council has resolved to endorse the views of the Ross Rural District Council, affirming: (1) That the county surveyor already had direct control of the main roads; (2) that it would be detrimental to make any change which should abolish local interest; (3) that overlapping would be greater, and it would be wasteful to have two sets of surveyors to go over the same ground; (4) that district surveyors were quite capable of carrying out repairs; and (5) that the change would entail great loss to the council in regard to the expensive plant obtained for the work of the roads.

Dorset C.C.—The council have decided to postpone till next spring the work of constructing the new main road to Lyme Regis.

Ham U.D.C.—The surveyor, Mr. R. W. Hindhaugh, has been asked to prepare an estimate for the repair of the footpath in Ham-street by laying Tarmac 5 ft. wide. This will be regarded as an experiment, and, if successful, may be extended to other parts of the district.

Hampshire C.C.—A claim presented to the Road Board for £4,932 in respect to extraordinary military traffic on the Tidworth and Grately road, the Amesbury and Weyhill road, and the Winchester, Alton and London road, has been reduced to £4,136 by the board and accepted by the council.

Hayle U.D.C.—The council have voted a sum of £100 towards the cost of repairing the road from the viaduct to Hayle Bridge. The estimated cost of the work is £700.

Helmsley R.D.C.—A petition has been sent to the Local Government Board and the county council asking for an increased grant in aid of the repair of the district roads which have been damaged by the timber hauling for Government purposes.

Holland C.C.—The Road Board have promised to

make a grant towards the cost of tarring Sleaford-road and Wainfleet-road, a width of 18 ft. to 20 ft. The contractors report that they will be willing to do the work at the same rate as last year—viz., 1d. and 19-20d. per square yard.

Llanelly R.D.C.—Some old property in Byrn-place has been offered to the council by the owner, Lady Howard, for widening purposes, on condition that the council defray the cost of making the road.

Londonderry C.C.—The necessary sanction having been obtained from the Local Government Board, the county council have agreed to borrow £10,000 to meet the expenditure to be incurred in making good the damage occasioned to roads and bridges in Limavady, Coleraine and Derry No. 1 by a rainstorm last July.

Perthshire C.C.—The Highland District Committee are considering the question of strengthening the roads in the neighbourhood of Loch Rannoch in connection with proposed works for the extensive haulage of timber.

St. Asaph (Denbigh) R.D.C.—A discussion arose respecting the tarring of roads, and members urged that it was time the council went in for their own tar-spraying machine, it being impossible to hire one. On it being stated that such a machine would pay for itself in about twelve months, it was decided to take steps to secure a machine, and to ask the St. Asaph (Flint) Rural District Council to join in the purchase.

Westhampnett R.D.C. The surveyor of the Lower District called attention to the difficulty experienced in obtaining the hand-picked flints allowed for that district, and suggested the use of gravel in place of the balance of flints required, approximately 2,750 yds. It appearing from information before the Highways Committee that there would be no difficulty in obtaining tenders for the supply of flints required provided the necessary labour to pick them could be obtained, it was resolved that the matter be left in the hands of the chairman to confer with the contractor, and to make inquiries in order to ascertain if the services of women could be secured to assist in picking the flints required.

SEWERAGE AND SEWAGE DISPOSAL.

Aldershot U.D.C.—Consequent upon complaints made by the Thames Conservancy Board with respect to the effluent from the sewage disposal works, the Health Committee recommend the construction of three primary, three secondary, and three tertiary beds at the works, and that one of the primary beds should be converted into an open tank, another primary bed to be constructed on a separate site in lieu of the one converted.

Burgess Hill U.D.C.—In ordinary times, the *Sussex Daily News* remarks, there would be interest just now in the peppermint crop grown on the Burgess Hill sewage farm, but in spite of the patriotic endeavour to further the cultivation of medicinal plants, the sewage farm is going strong this year on wheat and oats. Oats 7 ft. 2 in. high, and wheat 6 ft. high, with heavy crop of corn, are spoken of. Peppermint, it is stated, is a crop needing much labour to keep it clear of weeds, and labour is now scarce. It is also a very speculative crop, sometimes very remunerative and sometimes not. From accounts received of peppermint growing this year, the farm appears to have done well in reverting back to corn crops.

Chorley R.D.C.—The council have purchased a site at Heath Charnock for the purpose of a sewage disposal scheme.

Christchurch T.C.—The Local Government Board have declined to sanction a loan at present for a proposed surface-water drainage scheme.

Melton Mowbray U.D.C.—A modified scheme for the drainage of Asfordby Hill has been approved, and the inspector of nuisances has been asked to confer with the council with reference to a more elaborate scheme he has prepared, but which was considered to be too expensive.

Windsor R.D.C.—The Local Government Board have approved the plans and estimates of the Sunninghill and Sunningdale sewerage and sewage disposal scheme.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—For street repairs the estimate for the past year was £6,480, while the actual expenditure amounted to £3,345. For the ensuing year the estimate was fixed at £5,225, which is £1,255 under last year's estimate. This represents a saving of one-third of a penny in the £ in the rates. For the roads department the estimate last year was £12,373, and the actual expenditure £9,791, representing a saving of £2,582. For the ensuing year the estimate was fixed at £9,978, a reduction of £2,395 on last year's estimate, representing a saving on the rates of two-thirds of a penny. For the two departments the reduction in the estimate is £3,650, which will represent practically a penny in the £ less on the rates.

Ashton-under-Lyne T.C.—The Electricity Committee are asking the Board of Trade whether they will be prepared to consider an application by the town council to instal additional electricity plant.

Dundalk U.D.C.—A report is to be prepared by the surveyor, Mr. M. Sellars, and the electrical engineer on a proposal to heat the town hall and concert hall by means of electricity.

Dundee T.C.—It is stated that the reduction of the rates was practically due to the daylight saving Act and the compulsory reduction of street lighting, by which a saving of something like £8,000 can be effected.

Holywell U.D.C.—Attention has been drawn to the rapidly decreasing outflow of the famous well of St. Winefride, and it has been resolved to take steps to ascertain the cause, "with a view to safeguarding the vital interests of the town." Mr. Thomas Waterhouse, one of the members, said the cause might be found in the boring of tunnels, which was at present in operation, adding that if this continued Holywell would be drained of water.

Newton Abbot R.D.C.—The question of a water supply for Whilborough has been referred to the Parochial Committee for consideration and report.

Sheffield T.C.—It is intended to construct new electricity mains at an estimated cost of £1,000.

Sidmouth U.D.C.—On the recommendation of the Gas Committee, the council have agreed to pay £50 per quarter to the gas undertaking by way of compensation for the loss due to the non-lighting of the public lamps; also that the Finance Committee should pay to the gas undertaking £300 during the coming half-year should such a payment be required in order to provide working moneys. It was pointed out by the chairman that the restrictions of lighting and other conditions arising out of the war had necessitated the proposal, while the council, although possessed of the power to borrow up to £2,000 for the gas undertaking, was forbidden by the Treasury to incur any fresh loans.

West Ashford R.D.C.—It was reported that the Great Chart, Hothfield, Kingsnorth, and Shadoxhurst water scheme had been completed at a cost of £3,984, or £514 less than the estimated cost.

MISCELLANEOUS.

Alsager U.D.C.—The surveyor, Mr. H. V. Lynam, reported upon the wages paid to the council's employees, and, after discussion, it was resolved to advance the wages of the sewage works attendant by 2s. per week, and the wages of the roadmen and assistant pumper at the waterworks were increased by 1s. per week.

Axminster R.D.C.—The council have forwarded the plans of the surveyor, Mr. G. A. Millard, for dealing with the overflow of the river Coly into Tile-lane, Colyford, to the county council, asking for approval and contributions towards the cost of the proposed work.—The council have written to the Petrol Committee protesting against the allowance of petrol granted the surveyor for running his motor-bicycle. His average consumption was 10 gallons a month, and his allowance is only 2 gallons.

Blackpool T.C.—The committee in charge of the proposed extension of the promenade at South Shore have been asked to consider the desirability of constructing an open-air swimming bath in conjunction with the scheme of promenade extension.

Morecambe T.C.—The borough surveyor, Mr. F. W. Hopwood, has received instructions to prepare a plan and estimates for a new groyne at Bare.

FOR OTHER ADVERTISEMENTS
See End of Paper.

JUNIOR ASSISTANT (22 years), ineligible, seeks position in Surveyor's Office. Levelling, tracing and designing; clerical work if desired. Good references.—Box 1,581, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,078)

EXECUTION OF WORKS AFTER THE WAR.

PROPOSED OFFICIAL REGISTER: L.C.B. CIRCULAR TO LOCAL AUTHORITIES.

Sir H. C. Munro, secretary of the Local Government Board, has addressed the following circular to local authorities:—

I am directed by the President of the Local Government Board to state that the Government have under consideration certain questions which are likely to arise in connection with the demand for capital and the distribution of labour and employment at the close of the war.

It may perhaps be thought by some that it is premature to consider these questions in any detail at the moment. This is doubtless the case in relation to certain aspects of the question. Mr. Long feels, however, that due regard must be had to the magnitude of the questions involved, to the part which all classes of local authorities must take in furnishing information, and otherwise assisting in the solution of those questions and to the depleted staffs with which these local authorities have now to perform their duties.

Bearing all these points in mind, Mr. Long thinks that there may be distinct advantage in beginning the collection of some data which are necessary for the elementary consideration of the problems, and more particularly in such data as are likely to vary least with the progress of time.

He has in contemplation the establishment of a Register of Work available and likely to be undertaken at the conclusion of the war, and it appears to him that, while by no means excluding other sources of information, this can to a large extent best be compiled from information which local authorities may possess or be able to obtain both as regards works to be undertaken by them and also as regards other works to be undertaken in their areas.

Members and officers of local authorities have unique opportunities of obtaining accurate information on these points, and while Mr. Long would very much regret to add anything unnecessary to their labours at the present time, he feels sure that the advantage of starting betimes to obtain the material for such a Register as he proposes will be generally recognised. Consequently he appeals without hesitation to both members and officers of local authorities to take all steps within their power to obtain the material necessary to enable them to give as completely as possible the information asked for in the enclosed Forms A and B.

Mr. Long realises that it is impossible to forecast the position at the end of the war as regards either the supply of material or capital or the prices at which these can be obtained. These matters will largely affect the amount of work which will be undertaken at the end of the war, and may have the effect of materially restricting this work. At the same time the release of transport at present engaged on war work should have some effect in reducing the cost of imported materials, and there seems every reason to anticipate that plenty of labour will be available for almost every class of work.

So far as works to be undertaken by Local Authorities are concerned, these bodies will no doubt make such forecast of the future in their districts at the end of the war as their knowledge admits of, and will probably be able to say with some degree of accuracy what works they will be able or obliged to undertake when that time comes. Many of these works are of an urgent character, and have only been postponed in deference to the express desire of the Government to conserve all financial resources for the purposes of the war.

As regards works to be undertaken by private enterprise the case is more difficult, and Mr. Long recognises that the information obtainable cannot be regarded as absolutely reliable in all circumstances.

The inclusion of particular works in the Register cannot in any way bind the undertakers to proceed with those works, but it is hoped to secure, by means of the Register, a general idea of the character and extent of the works which may be undertaken at the close of the war and the capital and labour which they would absorb.

At the same time it is not desirable to include in the Forms particulars of works the putting in hand of which, upon the conclusion of the war, is for any reason problematical, but if on the other hand the works will be put in hand in the event of certain conditions being fulfilled the works should be included in the particulars given and the conditions subject to which they will be undertaken should be indicated.

Form A is intended to show the suggestions of each Local Authority as to works which might be undertaken by them in their various capacities on the conclusion of the war, and it is desired that it should be filled up as soon as practicable by the following Authorities: County Councils, Councils of all Boroughs and of Urban and Rural Districts, and any Joint Board consisting of representatives of any such Councils, Boards of Guardians of Poor-law Unions, the Metropolitan Asylums Board, and other Poor-law authorities having power to carry out works involving capital expenditure.

Form B is intended to show any definite information obtained by a Local Authority as to works contemplated in the area within their jurisdiction by bodies or persons other than the Local Authority, and it is desired that this form should be filled up by Councils of all Boroughs and of Urban and Rural Districts. This Form is therefore sent only to those Authorities.

If, as is possible, the information asked for in Form A can be furnished before that asked for in Form B, Mr. Long requests that Form A may be forwarded to this Office without waiting for the completion of Form B, which may be forwarded subsequently as soon as it can be completed.

In Form A local authorities are asked to furnish information under the following headings: (1) Short description of the works; (2) Degree of urgency; (3) Are the local authority prepared to undertake the works, subject to any necessary capital being available; (4) Approximate amount of expenditure involved; (5) Approximate period over which the works would extend; (6) Number of men who would be employed; (7) Authority for borrowing.

In Form B a short description of and the name of the body or persons proposing to undertake the works are asked for, other points on which information is desired being the approximate period over which the works would extend and the number of men who would be engaged.

PERSONAL.

Messrs. Jephson and O'Riordan, assistant county surveyors of Waterford, have had their salaries increased to £150, with an allowance of £25 for travelling expenses.

Mr. R. Kiernan, Dundalk, has been appointed surveyor to the Castleblayney urban district, in the absence of Mr. G. J. Skelly, who has joined the Royal Engineers.

Mr. F. E. Ennals, western district surveyor to the Billericay Rural District Council, Mr. R. J. W. Layland, western district surveyor, and Mr. S. J. Shelley, sanitary inspector, have been granted a war bonus of £10 each for a period ending six months after the proclamation of peace.

Mr. Charles W. Randall is leaving the Public Works Department, Hong Kong, having obtained an appointment with Dunlop Plantations, Limited, Malacca, Federated Malay States. Mr. Randall went to Hong Kong in March, 1913, under a three years' agreement, which has expired. Previous to that he was assistant surveyor to the Weybridge (Surrey) Urban District Council.

Mr. H. Wontner Smith, deputy engineer of the Bradford Corporation Sewage Committee, who has had charge of the Esholt tunnel undertaking, has been appointed manager of a large munition works in Lancashire. He will still remain in the service of the corporation, being enabled to take up the new work temporarily on account of the stoppage of the tunnel contract.

Mr. Clemens Herschel, who has recently succeeded Dr. E. L. Corthell as president of the American Society of Civil Engineers, is best known for his work in the field of hydraulics. His experiments in 1887 led to the invention of the Venturi meter and the derivation of the well-known formulæ for calculating the flow through large pipes. The principle upon which the Venturi meter is founded was first announced in 1797 in the published researches of J. B. Venturi, an Italian philosopher. He had observed that fluids discharging through an expanding nozzle exert a sucking action at the smaller diameter, which diminishes as the diameter increases toward the outlet. It is apparent that he considered this phenomenon scientifically interesting, but without practical value. Following Venturi, other engineers made occasional use of the peculiar property for various purposes. In 1887 Clemens Herschel conducted a series of tests to determine whether a definite relation existed between the difference in pressure at the inlet and contracted section and the rate of flow. Such remarkably uniform results were obtained that he patented the device, giving it the name of Venturi meter.

OBITUARY.

Mr. W. D. Gibbins, for many years borough engineer of Northampton, died, we regret to state, on Saturday last. After retiring he continued to act as architect to the Education Committee and surveyor to the Licensing Justices.

Captain Bernard Francis Cadic, who, we regret to state, has died from wounds and shell shock, was the son of Captain L. Cadic, R.E., now serving in the Naval Battalion of the Royal Engineers at the Front. Captain Cadic was educated at St. Lawrence's College, Ampleforth, Yorks, and served in the Officers' Training Corps. In 1912 he was articled to Mr. J. L. Redfern, borough engineer of Gillingham, Kent. Subsequently he was gazetted in the Territorial Force, R.G.A., and on the outbreak of the war was engaged on the Thames defences. Early in October, 1915, he proceeded to France with the 66th Siege Battery, and took part in the fighting in Flanders till June last, when he was wounded. He was only twenty-two years of age.

KILLED IN ACTION.

Captain E. W. Edwards, who before joining the Forces was surveyor and water engineer to the Blaenavon Urban District Council, was, we regret to state, killed in action on August 17th.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. JOHN S. BRODIE, M.INST.C.E., Borough Engineer and Surveyor, Blackpool.

District Chairman—Mr. J. S. PICKERING, M.INST.C.E., Borough Surveyor, Cheltenham.

SOUTHERN DISTRICT MEETING.

A Southern District meeting is to be held at Bristol on Saturday, September 16th.

PROGRAMME.

11.30 a.m.—Assemble at the Council House.
District Meeting.
Election of District Committee.
Informal discussion on papers describing works to be visited.

1 p.m.—Luncheon at Stuckey's Restaurant. (Tickets 2s. 6d. each.)
Drive to the Suspension Bridge, Clifton and Durdham Downs, Eastville refuse destructor, Barton Hill baths, inspecting en route six sections of bituminous road construction laid during the last four years. (Tickets for conveyance, 3s. each.)

6 p.m.—Tea at Stuckey's Restaurant by invitation of the city engineer.

NOTICES.

All members of the institution are cordially invited to attend.

In order that the necessary arrangements may be made, members must give notice of their intention to be present as soon as possible, and not later than September 9th.

F. R. PHIPPS,
Hon. District Secretary.
Borough Surveyor,
Basingstoke.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

CLERK OF WORKS.—September 14th.—Mullingar District Lunatic Asylum. £2 10s. per week. The Chairman, The Asylum, Mullingar, Ireland.

SURVEYOR.—September 14th.—Hollingbourn Urban District Council. £200 a year.—Mr. H. J. Bracher, clerk, Council Offices, 33 Earl-street, Maidstone.

SURVEYOR.—September 25th.—Warblington Urban District Council. £160.—Mr. J. W. L. Cooper, clerk, 14 Queen-street, Emsworth.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WOLVERTON.—September 16th.—For alterations to the bathing place, for the parish council.—Mr. R. Williams, clerk, Church-street, Wolverton.

Engineering: Iron and Steel.

BRADFORD.—September 5th.—For the supply of one Willans' two-crank compound engine, direct coupled to Phœnix multipolar generator, having an output of 300 kilowatts at 500 to 550 volts, and 260 cells for storage battery, made by the Hart Accumulator Company, for the corporation.—City Electrical Engineer and Manager, Town Hall.

CORK.—September 7th.—For sinking well and supplying and erecting pump, for the rural district council.—Mr. J. Cotter, clerk, Board Room, The Workhouse, Cork.

MANCHESTER.—September 9th.—For supplying and fixing a 500-gallon petrol storage tank, for the board of guardians.—Mr. J. Macdonald, clerk, Union Offices, All Saints, Manchester.

SHEFFIELD.—September 11th.—For the supply of materials and works in connection with the laying of cast-iron water pipe and construction of chambers, for the Electric Supply Committee.—Mr. S. E. Fedden, general manager and engineer, Commercial-street, Sheffield.

RHONDDA.—September 12th.—For the supply of two scavenging wagons, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

CAPE TOWN.—September 18th.—For the supply of pumps, motors, switch-gear, cables, cast-iron pipes, sluice valves, penstock gates and screens, overhead travelling cranes, and tipping wagons and rails, for the main sewage pumping station.—Messrs. Davis & Soper, 54 St. Mary Axe, London, E.C.

ARGENTINE.—October 13th.—For the supply of 27,807 metric tons of light pipes and 32,164 metric tons of heavy pipes of cast-iron, for the Ministry of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

SHEFFIELD.—For the supply of an electrically-driven pump, direct-current motor, boring plant, and rock-drilling apparatus, for the corporation.—General Manager, Water Department, Town Hall.

Mechanically-Propelled Vehicles.

SEVENOAKS.—September 11th.—For the supply of a steam motor wagon, with a separate tank of 1,000 gallons capacity, fitted for street watering, in addition to ordinary wagon-body, for haulage for the urban district council.—Mr. S. Towlson, surveyor, Argyle-road, Sevenoaks.

Roads.

LOFTUS.—September 2nd.—For the supply of broken whinstone and slag, for the urban district council.—Mr. Bernard J. Wormleighton, surveyor, Town Hall, Loftus, Yorks.

BEDFORD.—September 4th.—For the supply of 1,750 tons of broken granite, 4,740 tons of ironstone slag, and 1,600 tons of ironstone slag tar-macadam, for the corporation.—Mr. N. Greenshields, borough engineer and surveyor, Town Hall.

DEVIZES.—September 8th.—The town council have for disposal about 5 tons of Westrumite dust preventive, for roads.—Borough Surveyor, Town Hall.

MANCHESTER.—September 8th.—For the extension of granite rock asphalt carriageway, on concrete bed, for the corporation.—District Surveyor, Town Hall.

Sanitary.

GELLYGAER.—September 4th.—For the construction of sewage disposal works, for the urban district council.—Mr. T. R. Gabe, Council Offices, Hengoed, Glam.

SEATON DELAVAL.—September 4th.—For scavenging the district, for the urban district council.—The Surveyor, Council Offices.

EPSOM.—September 5th.—For the supply of horses and men in connection with the work of emptying cesspools, for the rural district council.—Mr. W. T. Wooldridge, surveyor, Waterloo-road, Epsom.

EPSOM.—September 5th.—For the removal of house refuse, for the rural district council.—Mr. W. T. Wooldridge, surveyor, Waterloo-road, Epsom.

ROWLEY REGIS.—September 5th.—For relaying and reconstructing sewers, for the urban district council.—Mr. W. Wright, clerk, Council House, Old Hill, Staffs.

BRIGHTON.—September 6th.—For the supply of glazed drain-pipes, for the corporation.—Borough Surveyor, Town Hall.

RATHDOWN.—September 6th.—For the extension of sewers, for the rural district council.—Mr. P. H. McCarthy, engineer, Clerk's Office, Loughlinstown.

CANNOCK.—September 7th.—For the removal of house refuse, for the rural district council.—Mr. J. T. H. Hall, The Oaklands, Brewood, Stafford.

HASLEMERE.—September 8th.—For the supply of about 350 yds. of hard crushed and uncrushed clinker for use as filtering media in percolating filters, for the urban district council.—Mr. H. V. Snook, surveyor, Council Offices, Haslemere.

MOTTRAM-IN-LONGDENDALE.—September 9th.—For cleansing closets and ashpits, for the urban district council.—Mr. S. Hudson, inspector.

BLAYDON.—September 12th.—For the removal of contents of ashpits, for the urban district council.—Mr. R. Biggins, Council Offices, Blaydon-on-Tyne.

Stores.

ROCHESTER.—September 5th.—For the supply of road metal, brooms, horse hire, and tools, for the corporation.—Mr. W. Banks, city surveyor, Guildhall.

SHEFFIELD.—September 11th.—For the supply of materials and works required by the Electric Supply Committee.—Mr. S. E. Fadden, general manager and engineer, Commercial-street, Sheffield.

Miscellaneous.

BRIGHTON.—September 6th.—For the supply of Portland cement, for the corporation.—Borough Surveyor, Town Hall.

BERMONDSEY.—September 8th.—For the removal of clinker and flue-dust from the destructor, for the borough council.—Mr. F. Ryall, town clerk, Town Hall.

NEWCASTLE-ON-TYNE.—For the removal of refuse to sea, for the corporation.—City Engineer, Town Hall.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

16.—Institution of Municipal and County Engineers: Southern District Meeting at Bristol.

21-22.—Municipal Tramways Association: Annual Meeting, Surveyors' Institution.

23.—Institution of Municipal and County Engineers: East Midland District Meeting at Melton Mowbray.

30.—Institution of Municipal and County Engineers: Eastern Sub-District Meeting (Suffolk, Norfolk, and Cambridge) at Stowmarket

30.—Institution of Municipal and County Engineers: North-Eastern District Meeting at Wath-on-Dearne.

OCTOBER.

7.—Institution of Municipal and County Engineers: Meeting at Watford.

APPOINTMENTS OPEN.

SOMERSET COUNTY COUNCIL.
Wanted, Temporary Assistant in County Surveyor's Office. Must have good knowledge of modern road and bridge construction, be an active motor cyclist, and ineligible for the Army. Salary £120 and allowance of £30 per annum for upkeep of motor cycle. Apply, giving age and full particulars of experience, to

GORDON R. FOLLAND,
Acting County Surveyor.

13 Chamberlain-street,
Wells, Somerset. (3,066)

HOLLINGBOURN RURAL DISTRICT COUNCIL.
APPOINTMENT OF SURVEYOR.

The Council invite applications for the Appointment of a Surveyor of Highways for this District at a salary of £200 a year, the duties to commence on the 1st day of October next.

The appointment to be subject to termination by six months' notice. Applications must be accompanied by three recent testimonials to be received by me not later than 10 o'clock on the 14th day of September next.

By order of the Council,
H. J. BRACHER,
Clerk.

Council Offices,
33 Earl-street,
Maidstone.
August 24, 1916. (3,077)

APPOINTMENTS WANTED.

ASSISTANT (25), rejected for Army, desires engagement. General experience; good testimonials.—Box 1,572, office of The Surveyor, 24 Bride-lane, Fleet-street, London, E.C. (3,073)

TENDERS WANTED.

RHONDDA URBAN DISTRICT COUNCIL.
Firms in a position and willing to supply Two Scavenging Wagons, which shall be made to tip, and shall be suitable to be drawn by horses or used as motor trailers, are requested to apply to the undersigned for particulars as to details, &c., and Form of Tender. Completed Tenders are to be received by the 12th September next.

E. HAZLEDINE BARBER, Assoc.M.Inst.C.E.,
Engineer and Surveyor.

Council Offices,
Pentre, Rhondda.
August 23, 1916. (3,075)

THE TOWN COUNCIL of the BOROUGH OF DEVIZES have for disposal about 5 tons (surplus stock) of Westrumite (dust preventative for roads). Offers for purchase of this are invited, and should be sent to the Borough Surveyor, Town Hall, Devizes, by Friday, 8th September. (3,074)

PREPARATION FOR EXAMINATIONS.

THE UNIVERSITY OF LIVERPOOL.
SCHOOL OF ARCHITECTURE,
including
DEPARTMENT OF CIVIC DESIGN.
Professor of Architecture
C. H. Reilly, M.A., F.R.I.B.A.

SCHOOL OF ARCHITECTURE.

The School provides a thorough theoretical and practical training for students wishing to enter the Architectural Profession. The courses, which lead to a degree (B.Arch.), a Diploma and a Certificate, begin on October 5th. After a two years' course students obtaining a first-class certificate are exempted from the Intermediate Examination of the Royal Institute of British Architects. A special certificate of the University is given in Architectural Design. The designs required as testimonies of study for the Final R.I.B.A. are made in the School as part of the second-year work.

DEPARTMENT OF CIVIC DESIGN.
Professor of Civic Design:
L. P. Abercrombie, M.A., A.R.I.B.A.

The department provides a training for Architects and Engineers who wish to specialise in Town Planning. The courses lead to a Certificate and Diploma. The session consists of the Autumn and Lent Terms. Autumn Term begins on October 5th.

Prospectuses of day and evening classes may be obtained on application to the Registrar of the University.

(3,076) EDWARD CAREY, Registrar.

MISCELLANEOUS.

WANTED.—Three Copies of The Surveyor, 15th April, 1910. No. 952; vol. xxxvii.—Apply to the Publisher, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

WANTED—The Surveyor, vols. xxxvii. and xxxviii. (1910), either in loose numbers or bound in publishers' cases.—Apply to the Publisher, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

The Editor invites readers to forward regularly copies of annual and other reports, for notice in the columns of "The Surveyor."

The Surveyor

And Municipal and County Engineer.

Vol. L. SEPTEMBER 8, 1916. No. 1,286.

Minutes of Proceedings.

Gas and Electricity.

It has become so much the custom to regard gas and electric supply companies as natural rivals that the idea of both commodities being supplied by a single undertaking will come as rather a novel one to many who are not acquainted with the latest developments in the gas industry. At a meeting of the North British Association of Gas Managers, held at Edinburgh on Friday last, however, Mr. J. W. Napier, of Alloa, in the course of a paper on "Gas Authorities as Suppliers of Electricity," was able to show from his own experience that in a suitable district the combination is a sound commercial proposition. An electric lighting Order was obtained in 1899, and the town council immediately concluded an agreement with a company for a bulk supply for a minimum period of fourteen years, the corporation taking delivery of the current at a sub-station in the town and undertaking the distribution by cables laid at their own expense. The arrangement, however, was doomed to failure, and this Mr. Napier attributes entirely to the excessive rates of charge imposed upon the town council. Finally the agreement was terminated by mutual consent, the corporation paying an indemnity of £3,000. The council then had to consider the question of erecting a station of their own. As Mr. Napier points out, the ideal site for an electric station is a point in the centre of, or so far as is practicable nearest to, the area of greatest demand for current, in order to reduce the cost of supply cables, which otherwise would require to be larger and carried a considerable distance at greatly increased cost. Ultimately the gasworks site was decided upon, and has proved most satisfactory, the convenience and advantages being real and considerable. Suction-producer gas plant with gas engines was decided upon as the most economical type of plant best suited to the local circumstances. In 1910, as a commencement, one 85-brake-horse-power and one 140-brake-horse-power gas engine, with dynamos direct coupled, with one producer gas plant for use with gas coke, were installed. These were added to in 1911, but three years later the demand for electricity had increased to such an extent that further extensions became necessary, and a much larger unit was installed—a vertical engine of 600-brake-horse-power, together with two sets of producer plant of ample capacity. The supply is on the three-wire system—200 volts for lighting and 400 volts for power. Since 1914 the output of current has rapidly increased, and at the present time a 700-brake-horse-power engine and generator are in process of erection. The greatest increase of energy has been for power purposes, and this has had a very important influence on the working results and success of the station. With an industrial day demand, and therefore a long hour-load, the plant is kept working when otherwise it would be largely standing idle, and would be running only during the short period of peak load. Between 1910 and 1916 the output of electricity has increased from about 100,000 units to about 800,000. At the same time every facility is given to consumers to take advantage of the use of gas, with the result that, taken on the basis of population, the consumption of gas is considerably higher than in most towns in Scotland.

The experience of Alloa certainly shows that in that district—which is typical of many others—electricity has a permanent place in public demand coincident with a large consumption of gas, and that competition does not enter in to destroy the interests of either department. There would seem indeed to be little danger that if a gas undertaking embarks upon an electricity scheme the consumption of gas will be lessened to make room for the new commodity. On the contrary, the electricity scheme may fairly be regarded as a means of pursuing the same line of business by a different avenue. There seems to be full justification for Mr. Napier's conclusion that if the area concerned is a suitable one (industrial to be preferred, in order to obtain the highly valuable day load) the electricity side of the business can be made independently remunerative.

* * *

The Management of Sewage Disposal Works.

The importance of providing for the proper management of sewage disposal works has been mentioned in these columns on a number of occasions in the past. A striking reminder of the fact was contained in a casual remark made in the course of a description of the new sewage disposal works at Caerphilly, which was printed in our issue of August 11th. These works were designed to deal with 160,000 gallons per day dry-weather flow, which amounts to about 260,000 tons per annum of foul sewage, together with the usual allowance of storm water, and the whole plant is so arranged that only one man is required to manage and control the entire process.

The figures would be still more striking in the case of larger works. This eminently satisfactory result is, of course, almost entirely due to the facilities provided by the engineers when they designed the works, by which it is made possible for one man to control and operate the various stages of the complete process of treatment through which the sewage passes before it is discharged into the stream in the form of a bright and perfectly clean effluent. In spite of all the engineer may do to render the work of the manager as easy as possible, and to make the operations automatic, where suitable, the human element is the most important factor in securing continuous satisfactory results. Lack of experience of the particular system in use, or neglect due to laziness, will soon spoil the best designed works and render them ineffective.

These facts are becoming more generally recognised than they were a few years ago, but instances still occur where a labourer of the "intelligent" type is considered good enough to have sole control of a sewage disposal works on the latest system. If the man has had no previous experience it requires a long time, and it is sometimes impossible, to teach him the fundamental principles of the various processes. On the other hand, the man who has had some slight experience elsewhere of some other type of treatment may, in excess of zeal, utilise the opportunities to apply the "little knowledge" he possesses with highly injurious results. Especially is this the case if some emergency should arise unexpectedly. There is some difficulty in ascertaining the capabilities of men applying for appointments as managers of sewage works, but this could be overcome if it were made essential that in every case the man should be able to show that he had had several years' actual experience under a member of the Association of Managers of Sewage Disposal Works before he was allowed to have sole charge of any works. The chief obstacle to the employment of competent managers is, however, the meagre remuneration so frequently offered for their services, and this is due to the ignorance of members of local authorities who cannot understand that a modern system of sewage treatment consists of a series of delicate scientific processes each of which requires the most careful regulation and adjustment in order to produce the conditions necessary for its successful operation. A proper knowledge of these conditions can only be attained after several years of practical experience, and even then sound judgment is frequently required to deal satisfactorily with contingencies which may arise unexpectedly in any works. A man with these qualifications is not willing to undertake the responsibilities of a sewage works manager for the wages of a labourer. At present the only apparent remedy is to do everything possible to enlighten the minds of the members of local and other authorities, first to the importance of securing proper management of their sewage disposal works, and secondly to the necessity of employing thoroughly competent managers, if they wish their works to be maintained in a permanently satisfactory condition.

* * *

Security of Tenure.

We have already published at length the excellent paper on "Surveyors: Their Security of Tenure and Defence," which was read at the recent Blackpool meeting of the Institution of Municipal and County Engineers by Mr. J. H. Drew, the engineer and surveyor to the Wath-upon-Dearne Urban District Council, and our own views on the subject are by this time well known to our readers. Judging, however, from the tone of the leading article in the August issue of the *Municipal Officer*, the official organ of the National Association of Local Government Officers, it seems that the peculiar position of surveyors as regards security of tenure is not yet appreciated, even by those whose special business it is to watch the interests of the Local Government service as a whole. Our esteemed contemporary evidently resents the suggestion that surveyors stand in greater need of some measure of security of tenure than any other class of municipal officers, and insinuates that any effort on the part of surveyors to act for themselves in this matter is something in the nature of an act of disloyalty to their colleagues in other branches of the service. With all our admiration for the work of the N.A.L.G.O., and our belief in the value of organisation, we are bound to say that we cannot agree with this view. That surveyors stand in special need of protection is clearly shown by the cases of wanton dismissal from office that are constantly occurring, the reason being that their work if conscientiously performed must in the nature of things often bring them into direct conflict with the worst type of local councillor. Nevertheless, we are told that, "whether the desire is to obtain security of tenure of office, superannuation, or any other improvement in the service conditions, we shall have to realise in the very first stages of discussion that methodical organisation of the whole forces of the Local Government service is the only way to success."

What, it may fairly be asked, has the N.A.L.G.O. done to further the *special* claims of surveyors to security of tenure? Whatever may be the answer to this question, there surely can be no objection to surveyors themselves strengthening the case for improved conditions by action through their recognised professional institutions? Our contemporary interprets the omission of Mr. Drew's paper from the realm of discussion at the meeting, not as indicating lack of interest in the question, but as showing that many surveyors are of opinion that the Institution of Municipal and County Engineers is not a body to spend its time upon questions affecting *service conditions* of its members. If this is the official view of the N.A.L.G.O., we hope that the council of the institution will not be long in correcting it. We have on many occasions expressed our sense of the value of the work of the N.A.L.G.O., and urged that all municipal engineers and surveyors ought to strengthen its hands by becoming members. This opinion we still strongly hold, but we do at the same time feel that any class of municipal officers having a special grievance must be free to secure its removal by organised effort in conjunction with, or if necessary apart from, the National Association.

* * *

The Birmingham Housing Proposals.

The difficulties, economic and administrative, which beset the housing question were promptly disposed of at the Trade Union Congress at Birmingham on Saturday last. A comprehensive resolution involving considerations of far-reaching importance was carried unanimously. This, while affirming the impossibility of local authorities framing housing schemes "that fulfil modern requirements, especially accommodation that can be let at a rental within the means of wage-earners," calls upon the Government to assist these authorities by contributing money from the National Exchequer equal to not less than 20 per cent of the sum sanctioned by the Local Government Board for the provision of housing schemes, and urges "that not less than £20,000,000 should be set aside for housing purposes." At the same time the resolution demands that, "in view of the reluctance of the local authorities to prepare housing schemes, the Local

Government Board shall issue a special order making it compulsory on local authorities to exercise their powers under the Housing Act, so that schemes can be proceeded with immediately after the termination of the war." It would be useless to deny that the local authorities have been faced with many obstacles in the desire to frame housing schemes that shall be established upon a financially sound basis, and if the truth were told this more than any supposed sympathy for private interests or the much-despised speculative builder has influenced them in their hesitant policy with respect to the provision of working-class houses. The proposals formulated at Birmingham would doubtless tend to remove the obstacles to municipal action, but they will need to be very carefully considered in view of the fact that they would presumably involve grants from the Exchequer in aid of land owners, wages, and rents. In view of this the further resolution passed by the conference protesting against the suggestion that "public money should be used to assist limited liability companies and private owners to build houses that will be let at rentals based on the ordinary laws of supply and demand," seems, it must be confessed, a trifle inconsistent. In any case, it is at least welcome to find that the Trade Union Congress should have crystallised their housing policy in a manner involving a clear-cut issue for public discussion.

* * *

Municipal Co-operation.

The very existence of the various institutions representing the professional interests of municipal engineers is in itself a recognition of the principle that the experience of each may with advantage be rendered available for the benefit of all. The same principle, too, affords the chief justification for the publication of technical newspapers, and the inclusion in their pages of tabulated information like the "Comparative Reports of General Practice" which have always formed such a popular feature of this journal. It would appear, however, that, notwithstanding the efforts of all existing agencies, there is still much duplication of time, labour, and expense in obtaining information about systems, costs and results in regard to various matters of municipal administration. In New York State an attempt has been made to promote efficiency and economy in the collection and dissemination of such statistics by the establishment of a central clearing-house of municipal information run on co-operative lines. The bureau serves fifty-seven cities, and its primary function is to supply information about any municipal problem to any New York State city official who may request it. It also keeps city officials in touch with one another by distributing new ideas and plans, while another duty performed is that of keeping cities informed about any legislation that may affect their interests. There is no organisation quite on these lines in this country, although much admirable work of a cognate kind is done by such bodies as the Association of Municipal Corporations and the District Councils Associations. Inasmuch as collated information of the kind indicated is of special value to the engineering officials of local authorities, the subject is one which has a peculiar interest for them, and we cannot but believe that the establishment in this country of a central bureau under official auspices similar to that now in operation in New York would result in a considerable saving both of time and money.

* * *

Work After the War.

There can be no question that the Government, through the Local Government Board, are acting wisely in taking steps to ascertain what public and other works will be ready for execution at the end of the war, with a view to the prompt organisation of the vast amount of labour that will be set free on demobilisation. In our issue of last week we published in full the text of an official circular on the subject which has just been issued to local authorities. The immediate object of the circular is to obtain material for the compilation of a register of work available and likely to be undertaken on the conclusion of hostilities, but its issue will certainly serve an important secondary purpose in leading local authorities towards a comprehensive and systematic investigation of after-war conditions. The information sought is not confined to works to be undertaken by local authorities themselves, and a second return is asked for showing any definite information obtained by a local authority as to works contemplated in the area within their jurisdiction by other bodies or persons. No local authority need be afraid of committing itself to any expenditure by filling in the returns, for it is made quite clear in the circular that the inclusion of particular works in the register cannot in any way bind the undertakers to proceed with those works, the general object being merely to gain as accurate an idea as possible of the character and extent of the works which may be undertaken at the close of the war and the capital and labour which they would absorb. The loyal co-operation of all will assist the Government in their difficult and important task of reconstruction.

* * *

Politics and Administration.

Although interference of a political or semi-political character with the purely administrative work of municipal officials is not entirely unknown in this country, it is at least satisfactory that the American system of appointment and dismissal on purely party grounds has no place in our system. We are glad to be able to record that even in America, in a recent case at Boston, some engineers who were employed by the city authorities and had been dismissed for political reasons have succeeded in their plucky fight for reinstatement. Under the guise of the abolition of positions for the sake of efficiency and economy these officials were summarily removed from office. They took legal proceedings with a view to securing reinstatement, and the evidence clearly showed that the real reason why their services had been dispensed with was lack of political activity in favour of the mayor, as shown by failure to attend party meetings and to contribute to party funds! It was further shown that in at least one case the successor of the dismissed official was incompetent. In these circumstances the judge decided that the men had been removed or displaced in bad faith, and ordered them to be reinstated. This result does great credit to the officials concerned, who, by their vigorous action, have struck a great blow for the cause of good, clean, municipal government in America.

War Minister and Drains.—Mr. Lloyd George (the *Times* reports) was taken to task by the chairman of the St. Asaph Rural District Council at the last monthly meeting for having on August 20th opened a Nonconformist hut at Kinmel Camp, near Rhyl, the plans of which had been returned by the council on the ground that the drains were not in order and had not been resubmitted. The chairman maintained that Mr. Lloyd George had no right to open a building before the plans had been passed, and suggested that he should be written to and asked by what right he did so. Other members of the council, however, objected strongly to this suggestion, and pointed out that Mr. Lloyd George would not know that the plans had not been passed, and that he was not supposed to inspect the drains of every building he opened. This counsel prevailed, and it was decided simply to call for the resubmission of the plans.

Some Ideas in Sewer Work.*

By W. G. CAMERON, B.Sc., District Engineer, Sewer Section, Department of Works, Toronto.

In the natural course of events, in sewer construction in the city of Toronto, a few ideas have been developed which, although not entirely new, are greatly in advance of methods formerly used. Although these new schemes have not entirely eradicated the faults which they are intended to correct, they have proved efficient in 99 per cent of the cases where they have been used. Accordingly, they have been universally adopted in the city. The more important of these developments are detailed herewith.

CANVAS COVERS.

In the case of tile-pipe sewers in wet trenches it was found almost impossible to prevent leaky joints.

Fig. 1.—Showing Canvas Cover in Place on Bell End of Pipe, Ready for Spigot End of Next Pipe.

This view shows the efficiency of these covers. Note the water in the trench, kept out of pipe by the covers over the joints in background, which are concealed under three inches of concrete.

The universal practice is to place a rope of gaskets around the spigot end of a pipe, and when this pipe is pushed home into the socket of the pipe previously laid, the gasket is pushed into the back end of the joint, thus sealing the opening. The remainder of the joint is then filled with neat cement. In a wet trench this cement will be washed out unless measures are taken to prevent it. In some cases grass ropes, sods, clay ropes, pieces of burlap, &c., are wrapped

Fig. 2.—Completed Canvas Cover on Joint.

around the joint; but they require a great deal of labour, and prove successful only where there is a small amount of water present.

The necessity thus presented itself of finding a method which would require less labour and be efficient in all cases, including the most difficult—that is, in running-sand trenches.

Canvas covers were designed, were tried out, and upon proving successful were put into general use. These covers, made of medium weight canvas, are turned under on each side, making a ¾-in. hem, through which No. 14 soft iron wires are passed. One side is fastened (by tightening the wire) behind the

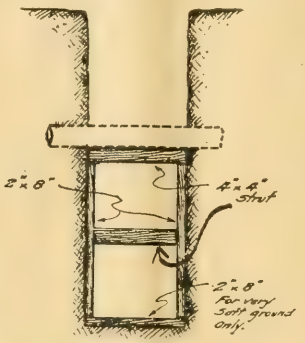


Fig. 3.—Protection Against Mains Settling.

collar of the pipe before it is lowered into the trench, and the other side is turned inside the collar. (See Fig. 1.) When the next pipe is ready to be placed, this side is pulled out, and when the joint is made, is fastened over the spigot end. Thus the joint is completely covered and protected. (See Fig. 2.) A different width and length of cover is required for each size of pipe. Fig. 1 shows how efficient are these covers. These covers were invented and designed by Mr. Worthington, chief sewerage engineer, Toronto, as was also the template described below.

TEMPLATE.

In Toronto, as in many other places, the Works Department requires 3 in. of concrete around all sizes of tile pipe over 12 in. in diameter. It has been found difficult to get the pipe-layer always to trim the sides of the trench so as to get a uniform 3 in. thickness of concrete. Most of these men are

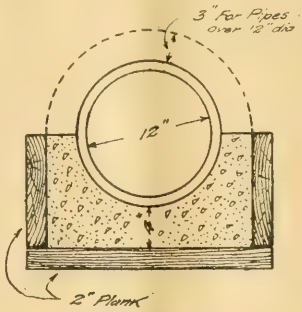


Fig. 4.—Type of Construction to be Used in Soft Ground.

foreigners and do not clearly understand when the inspector requests them to trim the trench properly. A collar or template goes over the pipe behind the bell and always shows clearly the width of trench required to give the necessary 3 in. of concrete around the pipe. The body of the template consists of four pieces of wood, each 2¾ in. wide by ⅞ in. thick, the length depending upon the size of the template, which, of course, depends upon the size of pipe. Two of these pieces are straight, for the sides. The two others, for the top, are cut so as to form a semi-circle. A

* From the *Canadian Engineer*.

light angle-iron, 1 in. by 1 in., is placed around the inner side, and the outside is covered by a 1-in. steel strap, ½ in. wide. The outer strap is raised at the top to form a handle.

SERVICE SUPPORTS.

Where a trench is opened in a built-up street there are always numerous gas and water services crossing the trench. These must be supported. If they are not, a sag will invariably occur when the weight of the back-fill comes on top of them. When these services are of iron, a low spot is formed, and probably they will pull out at the main, thus causing a leak. In the case of gas, moisture condenses and stays in the low spot, and in time causes interruption in the flow of gas. When the service is of lead, which is now generally used for water services, there is no danger to be feared from sagging, but it may pull out at the main and thus cause a leak. To avoid these troubles, it has been found advisable to use the following support, which is less expensive than repairs.—

Two legs 2 in. by 8 in. by length; one sill 2 in. by 8 in. by length under the tile pipe; one cap 4 in. by 4 in. by length; one strut 4 in. by 4 in. by length between the legs, to prevent them from buckling. (See Fig. 3.)

The size of this support may be increased when it is necessary to protect a main. For services the average bill of material is 30 ft. B.M. lumber, and requires from half to one hour's labour to cut the pieces and put them in place. The average cost is $1 for each service protected, while if the service is not protected and is subsequently damaged, the repair will cost from $5 to $10. Breaks or interruptions invariably occur either in the trench, union or main where proper protection is not given, while they practically never occur where the above-mentioned protection is used.

PROTECTION GIVEN TO A SEWER IN SOFT GROUND.

Where the ground is of a soft nature a pipe would unquestionably settle, or perhaps rise, as soon as placed. Under such conditions it has been found advisable to use the following construction:

The earth is taken out to a depth of 7 in. below grade and the trench made wider by 4 in. A box or trough is then made as shown in Fig. 4, 2-in. plank generally being used. This box is 6 ft. or more in length, according to convenience. It is lowered to the bottom of the trench and set to grade 5 in. below the grade of the pipe; 4 in. of concrete, 1:3:5 mix, is then placed in the box, the pipe set to grade, then the sides filled with concrete. Sometimes, where the ground is very soft, such as in the case of running sand, it has been found advisable to drive small stake-piles to resistance on either side of the trench, and about 3 ft. apart. Sills are placed on them across the trench and then the box is placed on these sills.

HIGHWAY SURVEYORS' SALARIES.

COUNTY COUNCIL'S OBJECTION TO INCREASES.

At last Tuesday's meeting of the Keynsham Rural District Council the receipt of the following letter from the clerk to the Somerset County Council was reported:—

"I am directed by the county council to give the rural district council notice . . . to terminate the present agreement for the maintenance and repair of the main roads on March 31st next. The reason for this notice is that one of the rural district councils has increased the salary of their surveyor without consulting the county council beforehand, and I am to inform you that the county council will be prepared to withdraw this notice on receiving an undertaking not to increase the salaries of any highway surveyor, his assistant or clerk, or the amount of the travelling allowance made to them in respect of their highway duties, so as to increase the amount of the charge to the county council under Clause 10 of the agreement, without the previous written consent of the county council."

The clerk (Mr. F. S. Whittuck) said that this seemed rather a high-handed action because one council—not the Keynsham Council—had broken away. They had always consulted the county council.

It was finally agreed that a reply be sent to the effect that the Keynsham Council had already agreed to the conditions laid down by the county council.

ABERDEEN WATER SUPPLY.

ENGINEER'S ANNUAL REPORT.

In his report for the year ended May 31st last, Mr. C. H. Roberts, M.INST.C.E., the city water engineer, states that the population supplied by the Aberdeen Water Department was about 166,000 persons. The area of the city is 6,748 acres, and the rateable value £979,350.

Owing to the balance from the revenue account of the previous year, the domestic water rate was reduced from 4d. to 2d. in the £, and the public water rate from 1d. to ½d. in the £. The charge by meter was reduced 12½ per cent from the charge of the previous year, which was 5d. per 1,000 gallons for the first 5,000,000 gallons, decreasing to a rate of 2d. per 1,000 gallons for all quantities in excess of 30,000,000 gallons during the year. The usual charges for miscellaneous purposes were reduced by 15 per cent.

During the past year the average rainfall in the Dee watershed above the waterworks intake, estimated from the gauges available, was about 45 in.; this is considerably above the average. It is equivalent to 346,000 million gallons of water. The water which flowed off this gathering ground, as observed at the waterworks intake, amounted to 223,000 million gallons, which is equivalent to an average rainfall of 29 in. The loss due to absorption by vegetation, evaporation, percolation and underground flow amounted to 123,000 million gallons, which is equivalent to 16 in. of rainfall. This loss is several inches greater than the average for the previous four years. The river during 1915 was not remarkable either for very low flows or for any excessive floods.

NEW WORKS.

The 1916 Corporation Water Act confers powers to make new waterworks at a cost of £450,000, and to abstract an additional 3,000,000 gallons of water from the river Dee, or a total of 11,000,000 gallons per day. The new works include intake works, storage reservoirs at Invercannie, additional filters, an aqueduct from Invercannie to the city, pumping station extensions, and a service reservoir near Mannofield. No money, however, is to be borrowed during the continuance of the present war and twelve months thereafter, unless the consent of the Treasury has been previously obtained.

By the Act Parliament confirms the principle that an abstraction of water from a lowland river is on a different footing to an abstraction from an upland stream, and that the provision of compensation, either in water or money, is not a necessary obligation in the former case. The corporation comes under the obligation to supply water if required on the route of the aqueduct to various places in the counties of Aberdeen and Kincardine, and to various landowners.

The new works at Invercannie, including alterations to the existing reservoir and the construction of new sand filters, &c., were completed in November, 1915; most of the filters had been in use for several months previously. The roofing-in with reinforced concrete of the No. 2 reservoir at Mannofield (378 ft. in diameter) was completed in the summer of 1915. The extensions to the irrigation farms of Tarland and Lumphanan were practically completed at the end of 1915.

The maximum day's consumption was 7,594,250 gallons. During the war, and owing largely to the effect of the war on the shipping trade, the consumption of water by shipping has fallen from 52,000,000 gallons to 26,000,000 gallons.

The average rate of working of the filters for the last seven months was 3,500,000 gallons per acre per day. This rate is higher than that which is usually expected to give the best results. It is, however, at present fixed by the area of filters constructed and by the area of land owned by the corporation. Mr. Roberts considers that the additional filters provided for in the Water Act should be constructed as soon as the war is over. The filters have had a considerable influence in reducing the colour of the water when brown. The total quantity of lime added to the water during the year was 130 tons.

Re-use of Old Wood Blocks.—The city surveyor of Gloucester, Mr. E. W. A. Carter, would be greatly obliged if any engineer who has had experience of taking up, redressing and relaying wood blocks would send him particulars.

THE INSANITARY GULLY.*

By J. T. Neech, M.D., D.P.H.,
Medical Officer of Health, Halifax.

In the sanitary progress of to-day, and among the improvements which have taken place in sanitary appliances generally, it appears to me that the time is more than ripe for the serious consideration as to the necessity for the continued use of the gully.

I am not going to say that catchpits and even gullies may not be necessary under special circumstances and for emergency requirements, but for general use in streets (especially paved streets), alleys, courts and back yards, they are, in my opinion, not required.

It would appear that the U trap, the self-cleansing trap, is a necessary evil; but the gully as it exists in general use to-day is an unnecessary abomination.

Take first the street gully, which is usually 12 in. in diameter, with a 6-in. outlet. Why is a 12-in. inlet necessary? Engineers do not, as a rule, connect up a 12-in. to a 6-in. sewer; but this principle is carried out in the street gully, with a miniature cesspool thrown in, holding 7½ gallons of solid and liquid filth. Into many of these gullies, in the narrower streets, household slops and other objectionable sewage matter is cast, there to undergo decomposition.

These gullies require periodical cleansing, and the usual method adopted is to remove the more solid contents with a scoop from the gully to the surface of the street. After a varying period a cart comes round to collect the material. It is impossible thoroughly to cleanse the surface of the street, and what is left dries into dust, and is scattered by air currents.

It is true that the suction method of emptying street gullies is on the increase, and it is an improvement upon the scoop method, because the surface of the street is not polluted, and the interior of the gully is better cleansed.

But by neither of these means can the gully be efficiently cleansed. The most thorough cleansing and purification of street gullies only occurs during heavy rains and continued wet weather.

The above state of matters constitutes a nuisance; the street gully is an insanitary appliance, and this nuisance could be largely obviated by substituting a 6-in. U self-cleansing trap, which holds about 5 pints, against 7½ gallons, which is the capacity of the 12-in. gully.

SINK WASTES.

With regard to the provision made in back yards for the reception of waste water from the sink, and surface drainage generally, gullies and traps of various sizes, shapes and capacities are met with.

Formerly it was the custom to provide a 6-in. gully for the sink waste, which would hold about 10 pints of liquid and solid filth, but in recent years the tendency has been to replace and substitute 6-in. and even 4-in. U self-cleansing traps, the capacity of the better made of the former being about 5 pints, and of the latter 3 pints. I contend that the smaller trap is the better from every point of view; it holds up the smallest amount of filth, its contents are frequently renewed, and it is consequently the most sanitary.

It matters not how much water is disposed of upon the sink, the contents of the 6-in. gully can never be completely changed and renewed, but 1 gallon of water will renew the contents of the 6-in. trap 1⅔, and the 4-in. trap 2⅔ times, and the more frequently the contents of a trap are renewed the cleaner and the more sanitary it will be. Again, the 4-in. trap is the less costly to provide.

AN IMAGINARY CASE.

In order to press the points I desire to emphasise a little further, let us take an imaginary town, possessing, say, 10,000 street gullies. As the average capacity of each gully is 7½ gallons, the combined contents of the above number of gullies would be 75,000 gallons.

Suppose, again, that our imaginary town contains 25,000 houses, each of which has a 6-in. gully with a capacity of 10 pints. The combined contents of the latter would be 31,000 gallons.

The total contents, therefore, of the street and sink gullies in such a town would consist of 106,000 gallons of decomposing filth, and the sewage of that town in gaining entrance to the drains and sewers would have, so to speak, to pass through a septic tank of that capacity. These gullies are not self-cleansing, so that it is practically impossible for any portion of the ordinary quantities of sewage discharged to enter the sewers in a fresh condition, and with each discharge there is carried into the sewers a quantity of decomposing sewage charged with noxious gases. Under such circumstances there is little wonder that foul odours emanate from sewers at certain times, at certain situations, and under favourable conditions.

Now suppose in this imaginary town the 10,000 street gullies were replaced with 10,000 6-in. self-cleansing traps, and 4-in. self-cleansing traps were substituted for the 25,000 sink gullies, the total capacity of both the latter would then be under 16,000 gallons. Which is likely to be the more harmful to public health, the holding-up of 106,000 gallons of decomposing sewage in miniature cesspools, or the holding up of 16,000 gallons in self-cleansing traps?

Again, as stated, it is practically impossible completely to renew the contents of the gully, whereas upon each occasion that 1 gallon of liquid is discharged through a 6-in. or a 4-in. self-cleansing trap a certain portion of fresh sewage gains access to the sewer, and as a consequence I contend that the sewers would be less foul than they are to-day.

TRAPS OR GULLIES.

Although advocating the substitution of 6-in. traps for the present street gullies, I do not pretend that such traps would not require inspection at regular intervals; and when it is considered that 10,000 to 15,000 gallons of water would suffice to change and renew the contents of 10,000 such traps, and suppose this were carried out fortnightly during dry and warm weather, would not a state of matters then exist from a sanitary point of view far preferable to that which obtains to-day? And the cost of such attention would be very much less than the cost of cleansing the present gullies.

The change here advocated would affect the work at the sewage outfall works, and no doubt this will be urged as an objection to the proposal.

The substitution of a trap for a gully could not increase the amount of sewage to be dealt with; hence there would be little or no difference in the cost as far as the tank or precipitation treatment of the sewage is concerned. There would, however, be an increased amount of sludge to be dealt with. But against that the cost of cleansing the gullies would cease.

I estimate that in the cleansing of 10,000 gullies by the scoop method, some twenty to twenty-five cartloads of sludge per week on an average would probably be removed, and, of course, the sludge at the outfall works would be augmented accordingly. The collection and disposal of gully sludge will cost from 8s. to 10s per load; or, to put it another way, the cleansing of each gully will cost from 1s. to 1s. 6d. per annum, but such cost will no doubt vary, according to local circumstances.

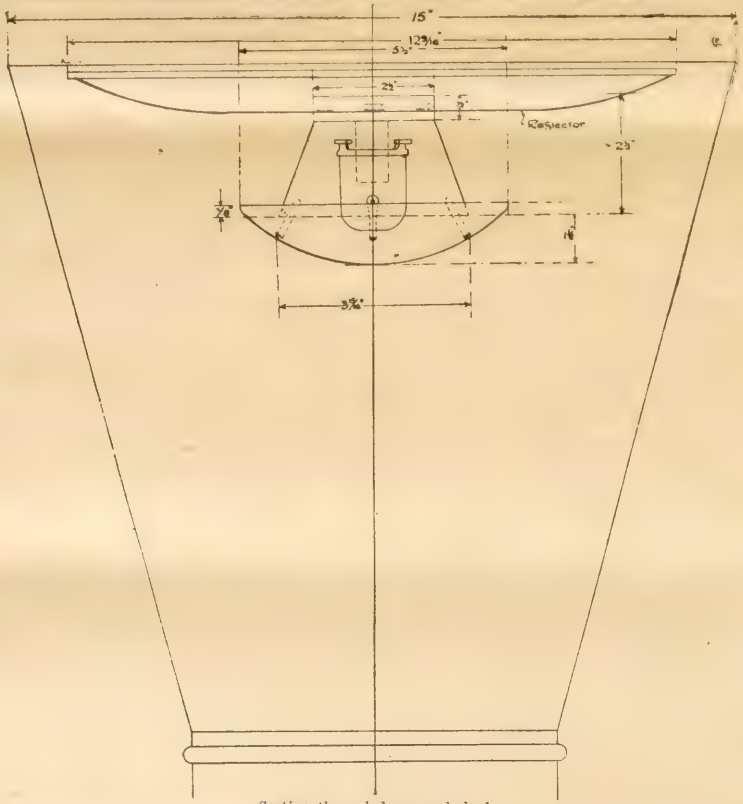
Again, under ordinary conditions, the purchase price of 10,000 gullies would be about £12,000, whereas a similar number of 6-in. traps would cost about £4,000. It seems, therefore, that the points raised are worth consideration from a sanitary, if not even from an economic standpoint also.

* Paper read at a sessional meeting of the Royal Sanitary Institute.

Sanitation in St. Germans.—At the last meeting of St. Germans, Cornwall, Rural District Council it was reported that Colonel Corkery (senior medical officer of the district) had written complaining of the water supply and sanitary condition of the village of Kingsand. The inhabitants had, he said, had no water for several days, and the whole village was in an insanitary condition. If immediate action was not taken he would take control of it as a military area, send to London for an inspection from the Local Government Board, and let all the charges be met from the rates, as he considered an epidemic might break out. The clerk said all Colonel Corkery could do was to complain to the Local Government Board that that council had failed in its duty, and if they considered that a strong case had been made out they would direct a local inquiry. Then, if they considered they ought to have provided water, &c., and had not, they could give an order for the work to be done, and if they did not do it they would appoint someone to do it at the council's expense. It did not want a colonel in the R.A.M.C. to do that. Anyone could do it; but it would take months to get water.

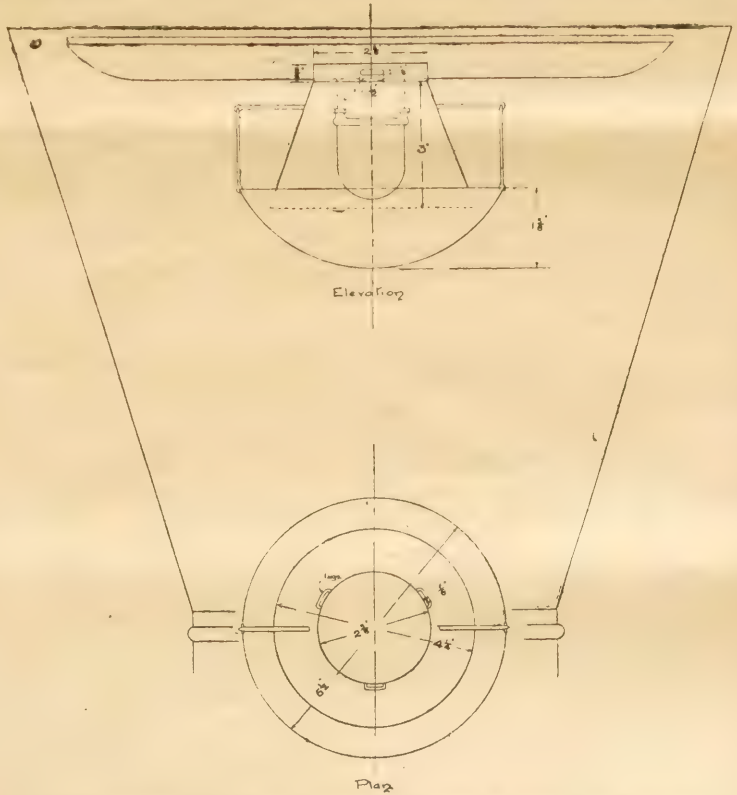
Officially-Approved Shades for Street Lamps.

The four designs for the masking of street lighting reproduced on this and succeeding pages have been forwarded to us by H.M. Office of Works. As will be seen, Nos. 1 and 2 are for use with inverted gas mantles, No. 3 for use with upright mantles, and No. 4 for use with an ordinary incandescent bulb. These designs have been approved, after test, by the authorities, and can be used without fee wherever desired. It should be noted that, where used, the dimensions should be rigidly adhered to, as any departure would violate the conditions laid down by the authorities for the use of such devices. The principle governing the design in all cases is that all light emitted is indirect, and that no light is visible at a point above the horizontal plane. The metal used is bright tin in all cases, and the construction can be of the cheapest and lightest form.



Section through lamp and shade.

(1) The device shows a plain cone with cylindrical top arranged for a bayonet fitting to suit the aperture in the ordinary street lamp, having suspended from it a circular dish. The whole is made out of bright tin. The approximate cost in large numbers would be about 6d. This pattern can be used only where a by-pass is provided.



(2) Similar to No. 1, but for such lamps where no by-pass is provided, the modification being that the bottom dish or reflector is swivelled as shown. Where this is used, some alteration of the lighting torch will be necessary. A small stud affixed at the top of the torch below the jet will be required. This stud will engage on the lower swinging portion of the device, and a pull downwards will expose the mantle to the lighting action of the torch.

MASKING DEVICE FOR STREET LAMPS, SINGLE BURNER, INVERTED GAS MANTLE.

(For designs 3 and 4 see overleaf.)

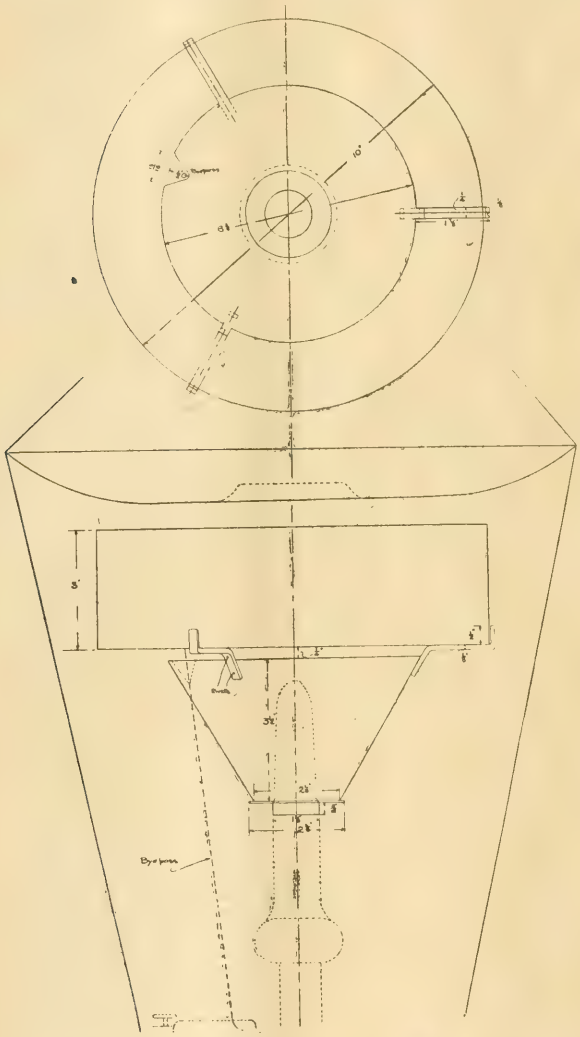
RURAL ENGINEERING.

WATER SUPPLY AND SANITATION.

By E. B. McCormick.
Office of U.S. Office of Public Roads and Rural Engineering.*

We are accustomed to think of the cool, shaded open well and the sparkling spring in some ravine as being the sources of drinking water that are far superior to any available to the city dweller. As a matter of fact the well curb may be lower than the surrounding ground, and the well may for years have been acting as a collector of germs of all kinds until even the bucket itself is lined with them. The spring may be, and many times is, merely the outlet of a drain from some field badly contaminated by sewage or other refuse, and the water from the spring may be loaded with germs, such as typhoid. A person drinking such water may, if the fortunate possessor of a strong constitution and under favourable conditions, maintain these germs within his system without fatal or even serious effects. It is a fact, however, that the per capita prevalence of typhoid and similar diseases is greater in suburban and rural communities than in the crowded cities, in spite of the slums existing in many of the latter.

In most localities in the United States it is easily possible to secure a reasonably copious supply of pure water, but the methods employed in one locality may not do in another. The constructions to be employed in securing the supply and protecting it after it is secured are, in the main, simple if adapted to the conditions. In many cases, through lack of sufficient forethought or knowledge on the subject, the source of water supply is located at the most inconvenient point on the farm, because of the belief that water can be obtained more readily there than at any other point. In many cases such location is absolutely unnecessary The engineer's knowledge may permit him to study the local information available on the subject of ground waters and locate the supply at a point which makes it most convenient to all operations of the farm.



Masking Device for Street Lamps, Upright Burners with Gas Mantles.

(3) The arrangement shown consists of a plain truncated cone with cylindrical base fitting around the lamp attachment supporting the mantle, having superimposed above it a plain circular band, 3 in. deep, supported by three light metal clips, the cone cut in one position to allow for passage of by-pass connection.

In two typical cases now, being worked out by the Office of Public Roads and Rural Engineering in adjacent localities, the conditions warrant in one case the use of a ram operated by the flow from an artesian well; in the other it has been decided that a gasolene engine and a deep-well pump will prove to be the best solution. In the one case an underground pressure tank can be used, located near the source of water supply, and furnishing water under pressure to all the buildings and feed lots; in the other case it has been about decided to use a combined system consisting of a pressure tank in the basement of the dwelling and a small storage tank located in one of the barns, and supplying two or three buildings and feed lots. The points that have been considered in determining the type of installation to be employed are the operations carried on, the contour of the ground, the location of the water supply, the location of the present buildings, which was already fixed, and the probable location of additional buildings to be erected as needs arise, not neglecting, of course, the amount of money that could reasonably be spent on the installation without raising the permanent investment beyond a point where returns might be expected.

The engineer may not stop when he has located the source of supply and arranged to protect it from contamination; his next step is to arrange for the distribution of the water to the farmhouse and the other buildings of the plant. With a knowledge of plumbing appliances and methods possessed by a competent sanitary engineer, the water supply can be carried into the house and to various parts about the farm at a comparatively low cost. With the system correctly installed, the first cost may be saved many times over in the operation of the entire plant through reduced labour and the consequent increased time for other work, to say nothing of the added convenience and pleasure to be derived from such an installation.

SEWAGE DISPOSAL.

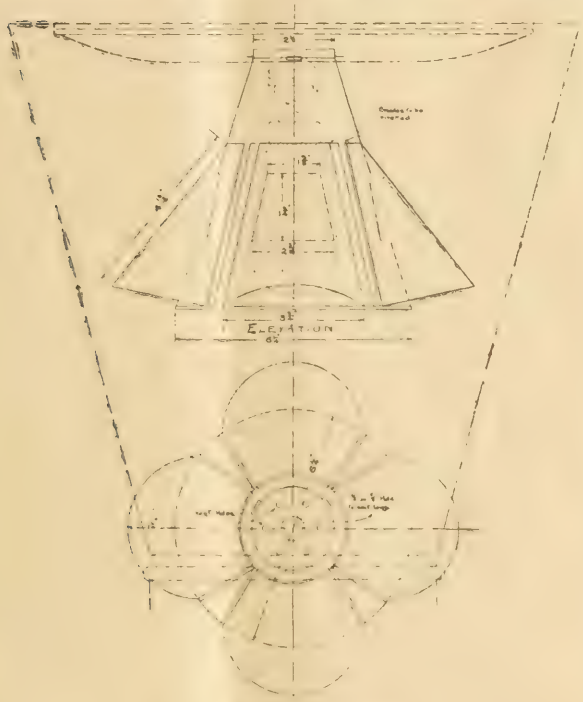
Closely connected with the problem of water supply is that of sewage disposal. Formerly it was considered that but one of two methods was available for the disposal of human excreta—that of a com-

* Extract from Year Book of United States Department of Agriculture for 1915.

municipal sewer or open privy vaults. To-day there are in use several methods lying between these two.

A vault may be used and rendered to a great extent sanitary. Cesspools under certain conditions may be advisable. A septic tank with some one of several forms of distribution and irrigation may be found to fit the needs and be within reasonable limits of expenditure.

Even more than some of the other problems of rural engineering, that of sewage disposal is one whose solution is determined to a great extent by the local conditions. An installation that has proven satisfactory in some cases has turned out to be a complete or partial failure when applied under other circumstances. In order so to design and locate a disposal plant that contamination is avoided, not only on the premises of the owner but on those of his neighbours, requires the services of a man who not only has the necessary scientific training, but who can draw from his own experience and from that of others.



PLAN LOOKING DOWN

SHADE FOR INCANDESCENT ELECTRIC BULBS.

1. The device consists of a plain cone with a closed base and cylindrical top. Top to be closed with the exception of an orifice to permit of the wires or end of the lamp-holder passing through. The cone has four irregular rectangular openings through which the light passes, but all direct rays of light are cut off by superimposed hoods, as shown in the sketch attached. In order to obtain the calculated effect, the position of lamp should in all cases be as shown in sketch.

Road Upkeep at Paignton.—Moving the adoption of the Roads Committee's report at the last meeting of the Paignton Urban District Council, Mr. Hill expressed regret that the estimates were cut down. The roads were in a very bad state, especially the country roads. The metal used was totally unfit for the roads, and if a frost was followed by a heavy thaw, the roads would be in a terrible state. There were 73 miles of country road, and they had only £750 to spend on them.

Torquay Pavilion Finances.—The Torquay Entertainment Committee report a net loss on the pavilion, café and gardens for ten months of £2,777, against £3,501 last year. It is understood that a supplementary report showed that the committee had received two offers, which were regarded as highly substantial, to lease the pavilion, and therefore it was deemed that there was no need at present for the consideration of a proposal for the temporary closing of the building.

PLANNING OF MUNITION WORKERS' HOUSES.

A LOCAL AUTHORITY'S PROTEST.

At the last meeting of the Hawarden Rural District Council the Health Committee reported a communication from the Ministry of Munitions stating that they proposed to erect forty houses in the neighbourhood of Mancott to accommodate their firemen and policemen.

It was agreed to take a census in that district to ascertain how many of the numerous men in lodgings there were in direct employment of the Government or in the employment of their contractors. It was stated that houses erected in the district for the accommodation of Government employees had no means of access to the backs.

Mr. Moulsdale and Mr. John Jones complained of neglect to comply with the council's by-laws in the erection of these houses.

Mr. Moulsdale said the Local Government Board held the council to their by-laws, and he thought the Government ought to set an example to others in such matters.

The surveyor pointed out that these buildings were exempt from the council's by-laws. They were buildings authorised by one of his Majesty's principal Secretaries of State, and as such the builders were not bound to submit plans to the council.

Mr. T. Rowland said that might be so, but the Local Government Board approved of their by-laws, and they ought to adhere to the by-laws themselves. Every working man who built a house had to adhere to the by-laws, but the Government, or their representatives, just took the bull by the horns and did as they liked.

Captain Phillips said it seemed that the Government could build as they liked, and ignore the local authority.

The Rev. J. J. Robinson also objected to the council being ridden over in such a roughshod manner by the Government. He suggested the passing of a resolution of protest to the Government.

The clerk advised that the resolution should be toned down a bit, because any building in his Majesty's possession, or employed, or intended for his Majesty's use or service was expressly exempt from the by-laws. He would rather address to the Local Government Board a communication pointing out that the council were responsible for the health of the district, even if it was injuriously affected by Government buildings, and would be called upon to provide sewers for those buildings if necessary, and that they were obliged to enforce the by-laws upon private individuals, however poor they might be.

It was decided to leave the matter in the hands of the clerk.

Johannesburg Swimming Bath and Wash-houses Scheme. A scheme for the provision of a swimming bath and wash-houses in Newtown, Johannesburg, is referred to in the report of Mr. G. S. Burt Andrews, the town engineer, for the year ended June 30th last. The wash-houses will have accommodation for thirty users, and each person will be provided with a special rack with quick-drying apparatus. A large ironing room will also be provided, as well as offices, and space will be left to allow of extensions in the future. The swimming bath will have a pool 50 ft. by 100 ft., with dressing-boxes on the ground and first floor levels, the former being for men and the latter for women. There are in all fifty-five dressing-boxes. There is also a large apartment for children's dressing purposes, with the usual offices. The estimated cost of the two buildings is £12,000.

The Extent to which Sewage can be Purified by Practicable Methods of Artificial Treatment now in Use.*

By HARRISON P. EDDY, Boston, Mass.

All of the fundamental principles of sewage disposal and treatment now available had been recognised and actually utilised twenty-five years ago. Coarse screening has been practised at Boston since 1884, and the Massachusetts Metropolitan Sewerage Commission put the Deer Island submerged outlet into use in 1895 for the purpose of furnishing adequate dilution to the coarsely screened sewage from the northern portion of the Metropolitan District. Paris and Berlin have been applying their sewage to broad irrigation farms for more than thirty years; the Welsh town Merthyr Tydvil treated its sewage by intermittent sand filtration as long ago as 1871. Sedimentation was used in England many years ago, and in 1870 chemical precipitation was well established there. Over twenty-five years ago Webster had invented an electrical method in which the suspended matter was precipitated by a process closely akin to chemical precipitation, and combining therewith, at least in principle, the killing of organisms, or disinfection.

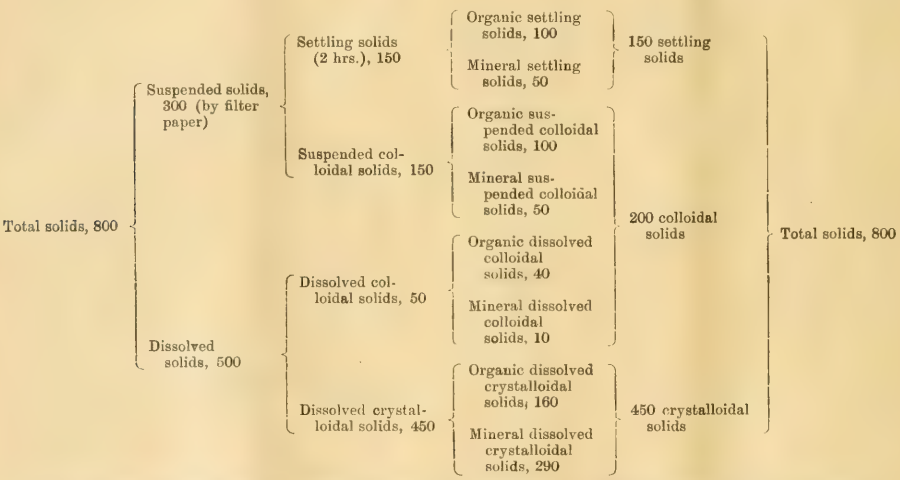

Total solids, 800
Suspended solids, 300 (by filter paper)
Dissolved solids, 500
Settling solids (2 hrs.), 150
Suspended colloidal solids, 150
Dissolved colloidal solids, 50
Dissolved crystalloidal solids, 450
Organic settling solids, 100
Mineral settling solids, 50
Organic suspended colloidal solids, 100
Mineral suspended colloidal solids, 50
Organic dissolved colloidal solids, 40
Mineral dissolved colloidal solids, 10
Organic dissolved crystalloidal solids, 160
Mineral dissolved crystalloidal solids, 290
150 settling solids
200 colloidal solids
450 crystalloidal solids
Total solids, 800

Fig. 1.—Physical Condition of Principal Constituents of Sewage of Medium Strength (Parts per Million).

Note.—The suspended solids include all substances retained upon ordinary laboratory filter paper. "Dissolved" colloids is a term coined to apply to substances which will readily pass through the filter paper, but which are colloidal.

The fact that these principles were known and applied a generation ago is seldom recalled by those at work upon similar problems to-day. The progress of the last twenty-five years has been in acquiring a correct perspective of the problems of sewage disposal, a better understanding of the principles upon which the processes of sewage treatment are based, and in perfecting such processes and the means of applying them. Much progress has been made along these lines, and there are now a number of modifications of each of the fundamental processes in use a quarter of a century ago.

It should not be inferred from the foregoing that little real progress has been made during this time, for this is not the case. Marked improvement has been made in screens, particularly those intended for the removal of the finer suspended particles. The laws affecting sedimentation are better applied, the most radical and important changes being those due to the theories that the period of retention in tanks should be reduced to a minimum consistent with efficiency in removal of those solids capable of settling in a reasonable length of time, and that the settled solids should be promptly removed from contact with the partially clarified sewage. The greatest advance in the art has been the development of the process of bacterial oxidation by means of surface contact in bacteria beds. This process, as applied in intermittent filtration through sand, was comparatively well known twenty-five years ago, but the difficulties resulting from lack of suitable natural sand deposits led to the discovery of means of using other material, such as cinders and broken stone, by devices known as contact beds and trickling filters. These two methods, although involving substantially the same principles as intermittent filtration, generally accomplish much different results, and have proved to be substantial aids in the solution of the sewage treatment problem in many places. Disinfection has made distinct advance, and whereas it was hardly more than an experiment twenty-five years ago, its value for safeguarding water supplies and shell-fish layings has now been demonstrated.

At the present time we are just over the threshold of a newly discovered process known as the activated sludge treatment. While the fundamental principles upon which it depends may not have been fully ascertained, the information available indicates that they are substantially the same as those of the processes now used.

Composition of Sewage.

In order to consider intelligently the several available methods of sewage treatment and their relation one to another, it is necessary to obtain a clear understanding of the general ingredients of sewage.

The physical condition of the principal constituents of a hypothetical sewage of medium strength is shown in diagrammatic form by Fig. 1.* It should be noted that in this illustration there are three classes of substances—suspended, colloidal and crystalloidal. The first and second of these can be removed physically without change in composition, while crystalloids are dissolved and must be changed in chemical composition before they can be removed or altered in character. It will also be seen that 400 parts per 1,000,000 are organic and 400 parts are inorganic or mineral. The latter substances are not ordinarily capable of producing putrefactive conditions, and the problem of sewage disposal is con-

* Paper read before the Engineers' Society of Western Pennsylvania.

* *American Sewerage Practice*, vol. iii., p. 200.

cerned almost wholly with the organic matter. This is disposed as follows:—

Settling solids	100	parts
Suspended colloids	100	,,
Dissolved colloids	40	,,
Crystalloids (dissolved)	160	,,
Total	400	,,

The settling and colloidal substances, therefore, constitute 60 per cent., and the dissolved crystalloids but 40 per cent of the total organic matter.

Where sewage is deprived of its objectionable characteristics by artificial treatment, one or both of two fundamentally different processes are generally employed—first, the actual removal, or taking out of the sewage constituent parts, as, for example, such substances as paper, corks and garbage which may be removed by screens; secondly, the conversion of putrescible organic matter into stable substances. The former class of constituents is confined primarily to the suspended matter, while the latter comprises both suspended and dissolved substances.

DILUTION.

All sewage must ultimately reach natural streams or bodies of water. When the quantity of sewage is small in comparison to that of the body of water into which it is discharged, sewers are usually designed to empty their contents directly into it, without previous treatment. Under such conditions the waters are able to assimilate the organic sewage matter, a process constantly going on in Nature.

The velocity of a flowing stream may be a very important factor in the disposal of sewage by dilution, for it may thus be enabled to convey the suspended and dissolved sewage matter to a large body of water where ample dilution is afforded, in so short a period of time that the ill-effects of the admixture of sewage with even a relatively small quantity of river water may not become evident.

In general, however, the sewage matter must be changed from its natural putrescible condition, either into innocuous mineral substances or into other matters which are organic in nature, but relatively stable, so that they cannot be the cause of putrefaction. Such a change is brought about through the agency of living organisms, the most numerous and probably the most potent of which, in the majority of cases, are bacteria, although the microscopic organisms, such as various kinds of algæ, are exceedingly important factors in the cycle through which the constituents of organic matter are continuously passing in Nature's process of transforming organic matter into mineral substances and these back again into organic matter.

It may be said safely, therefore, that practically the whole process of sewage oxidation in Nature appears to depend upon the micro-organisms. In artificial treatment also practically all methods involving oxidation of organic matter appear to depend upon living organisms and their products. So it is important to bear in mind that to secure effectiveness and efficiency it is necessary to create conditions favourable to the growth and reproduction of these minute organisms. Such conditions are provided by natural agencies when the relative proportion of sewage to diluting water is small. It is necessary to adopt artificial means only when the relative quantity of sewage becomes disproportionate to the capabilities of natural waters for its oxidation. Under these conditions the first step toward artificial control may be to create a more complete distribution of the sewage through the diluting waters, thus overcoming the effect of an overload due to the concentration of the sewage in a small portion of the diluting water. The advantage of this is often overlooked.

ARTIFICIAL MEANS OF SEWAGE TREATMENT.

The objects of artificial treatment, with the methods by which they are attained, may be classified as follows:—

A. To prevent waters into which sewage is discharged from becoming offensive to the eye on account of coarse floating and suspended matter.

Screening.
- (*a*) Coarse.
- (*b*) Fine.

B. To prevent such waters from becoming malodorous.

1. Sedimentation.
   - (*a*) Rapid in grit chambers.
   - (*b*) Slow in settling basins.
     - Plain.
     - With septic action in single-storey tanks.
     - With sludge digestion in two-storey tanks.
     - With chemical precipitation.
     - With electrolysis and chemical precipitation.
     - With colloiders.
2. Aëration, contact with the organisms or sludge from previously aërated sewage, and sedimentation.
3. Contact bed treatment.
4. Trickling filter treatment.
5. Intermittent filtration.
6. Broad irrigation.

C. To prevent the introduction into the water of germs of disease.

Disinfection.

The treatment of sewage may be accomplished by a single process in some cases, but usually it is effected by a series of steps, the degree of purification increasing with each successive stage. If raw sewage may be discharged into natural waters without creating objectionable conditions other than offending the sense of sight, the simple process of screening may suffice, but if it is necessary to remove more of the matters likely to settle, sedimentation may be adopted as an adjunct to or substitute for screening. Where the diluting waters are so limited in quantity that it is necessary to supplement their powers of oxidation, some method of artificial oxidation must be adopted—such, for example, as filtration through beds of sand or stone which form the habitat of bacteria and other organisms capable of bringing about the more or less complete and rapid oxidation of the organic matter of the sewage. Under still more exacting conditions it may be necessary to go further with the removal of pathogenic organisms. The final process would then be disinfection, through which a large proportion of the harmful bacteria may be eliminated even from settled sewage. In such a case the treatment would involve four successive steps—namely, screening, sedimentation, oxidation by filtration or other means, and disinfection.

SCREENING.

Municipal sewage contains many relatively large and coarse substances such as cloth, paper, garbage and pieces of wood, which may interfere with pumping and other machinery and prove unsightly in the waters into which the sewage is discharged.

Such substances may be removed by coarse screens, which often consist simply of parallel iron bars, or gratings, set vertically or at an angle of from 30 to 60 deg. with the horizontal, through which the sewage flows and upon which the very coarsest of the suspended and floating matter is retained.

Coarse screens will remove only from 5 to 10 parts per 1,000,000 of suspended matter originally contained in the sewage. This is usually sufficient for the protection of machinery and is regarded as sufficient for all purposes in some cases where sewage is discharged into large quantities of diluting water, as into the tidal waters of Boston Harbour, off Nut Island.

If, however, sewage is to be discharged in relatively large quantities into waters used for boating and other pleasure purposes, coarse screens cannot be relied upon to remove all of the suspended matters which are recognisable as being of sewage origin, and which, therefore, may be considered as offensive to the sight. Where such substances must be removed and also where a somewhat greater reduction in the organic matter is required, fine screens may be used, either by themselves, or supplementary to the coarse screens. Numerous types of fine screens have been perfected and placed upon the market, among which may be mentioned the Weand screen, first installed at Reading, Pa.; the Jennings screen, used at the Union Stock Yards in Chicago; and the Riensch-Wurl screen, used in Germany, and being installed to a limited extent in this country. The Weand screen consists of a horizontal revolving drum covered with a fine mesh screen. The sewage is discharged into this drum at one end and flows out through the cloth, which retains the suspended matter until it is washed off into suitable receptacles by jets of water. The Jennings screen is of the moving band type, the lower end being submerged in the sewage, which flows through the screen cloth, which retains the suspended matter and carries it up out of the sewage. When

the screen has passed over the pulleys at the top, the screenings are blown off into a pit by a jet of compressed air applied to the back side of the screen. The Riensch-Wurl screen, which is typical of its class, consists of a disc of perforated metal, with or without a frustrum of a cone attached to its centre, the whole being mounted on a shaft whose inclination from the vertical determines the degree of tilting of the disc. As the screenings are raised above the surface of the sewage by the revolving disc and cone they are swept into a circular gutter, by brushes on the ends of the arms of a large spider. Where the screen is surmounted by the frustrum of a cone the side of the cone is cleaned by a brush inclined against its surface.

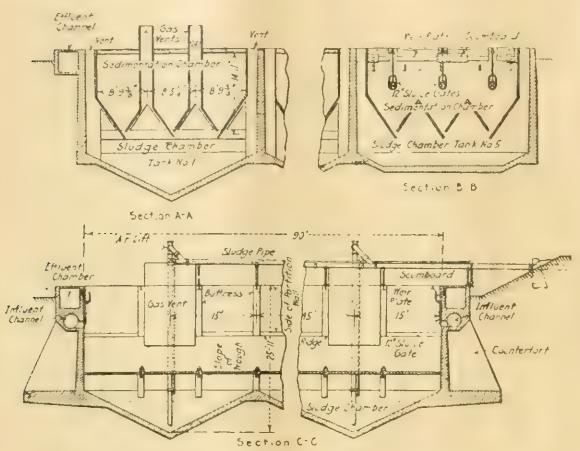


Fig. 2.—Sections of Imhoff Tank at Fitchburg, Mass.*

The quantity of suspended matter removed by fine screens varies with their efficiency and the quality of the sewage. Such screens may remove from 20 to 70 parts, averaging perhaps 50 parts per 1,000,000 of suspended solids.

SEDIMENTATION.

It has been claimed sometimes that with the most effective fine screens the organic matter may be removed to such an extent as to greatly reduce the oxygen requirements of the sewage, and thus make it possible to dispose of a much greater quantity of screened than of raw sewage in a given quantity of diluting water. The consensus of opinion, however, appears to be that, while the reduction of organic matter by fine screenings may be considerable, it will not be enough to greatly increase the quantity of sewage which a given stream or body of water may receive and remain in a satisfactory condition. Grounds for this opinion will be apparent when it is considered that much of the coarse suspended matter in sewage consists of materials like paper, matches and coffee-grounds, which are relatively stable organic substances and which do not constitute so great a tax upon the diluting power of the water as equal quantities of fæcal and other polluting substances which are more finely divided and consequently which are not so completely removed by screens. Therefore, where it is necessary to increase the quantity of sewage which may be discharged into a body of water, sedimentation in some form is generally adopted.

Grit Chambers.—The grit chamber ordinarily is merely an adjunct to the main process of sewage treatment, its function being to remove the coarser sand and gravel commonly called grit, which might cause excessive wear of moving parts of machinery, or cause deposits in tanks or elsewhere which would prove more expensive to remove from such tanks than from grit chambers. There is much diversity in the design of such chambers, the older ones and those most commonly in use in England being so large that they permit the sedimentation not only of the grit or mineral matter, but also of much of the organic sewage matter. Such deposits are relatively large in quantity and exceedingly offensive in character. They are removed by manual labour, being shovelled, after draining, into buckets, or they may be dredged by various types of excavators capable of removing the grit from beneath the surface of the sewage, thus avoiding the emptying of the chambers. The more modern type of grit chamber, which may fairly be said to have originated in Germany, consists of one or more narrow channels, through which the sewage is allowed to flow at velocities closely approximating 1 ft. per sec., at which the sand and gritty matter will deposit. These chambers are in turn shut off and drained, and the grit removed, ordinarily by manual labour. Under the best conditions this grit consists of a mixture of various sizes of sand, comparatively little of which is finer than ordinary mortar sand. It contains relatively little organic matter, perhaps from 15 to 25 per cent, and is less offensive than the grit removed from the larger and older type of chambers, where the velocity of flow is much lower. The quantity of grit removed will vary roughly between 10 and 40 parts per 1,000,000.

Plain Sedimentation.—Plain sedimentation may be assumed to mean the process by which sewage is allowed to flow through horizontal or vertical tanks at velocities sufficiently low to permit substantially all of the suspended matter capable of settling in a reasonable length of time to fall to the bottom of the tank, where it accumulates in the form of mud, commonly called sludge.

It is necessary to remove this accumulation from time to time, and it may be said in a general way that a plain sedimentation tank should be cleaned at intervals of from three to six weeks, depending upon the season of the year, or, more accurately, the temperature of the sewage. The object is to remove the sludge before decomposition becomes very active and causes portions of it to rise through the sewage, form a well-defined scum, or pass out of the tank in the effluent.

Septic Tank Treatment.—The septic tank, a patented device, is similar to the plain sedimentation tank; in fact, there is scarcely any difference between the two, except in the method of operation. The septic tank is distinguished by being so operated as to ensure the absence of dissolved oxygen in the effluent and to permit of more or less complete decomposition of the solid substances in the sludge. This decomposition is accompanied by the production of large quantities of gas, due to biological action, and the gases are retained until the mass becomes sufficiently buoyant to rise rapidly to the surface, sometimes giving to the tank the appearance of ebullition. With these gases also rise large quantities of suspended matter, much of which is relatively coarse, especially if the sewage has not been screened, or has been screened only through coarse racks. This suspended matter holds entrained the gases, which in turn cause it to float at the surface of the tank. Repeated ebullitions of this kind cause the gradual accumulation of greater and greater quantities of this floating coarse

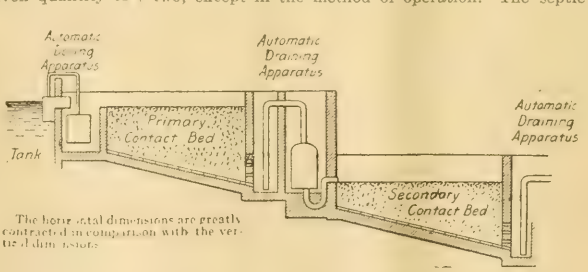

Automatic Dosing Apparatus
Automatic Draining Apparatus
Primary Contact Bed
Tank
Automatic Draining Apparatus
Secondary Contact Bed
The horizontal dimensions are greatly contracted in comparison with the vertical dimensions

Fig. 3.—Typical Section through Double Contact Beds.*

* From *American Sewerage Practice*, vol. iii., "Disposal of Sewage."

The Surveyor
And Municipal and County Engineer.

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suspended matter, which ultimately forms a thick scum attaining in some cases a thickness of 2 ft. or more.

The septic tank, which at one time was looked upon with favour by some engineers, did not prove as satisfactory as was originally anticipated. The continuous evolution of gas from the sludge causes large quantities of suspended matter to be continually rising and falling through the liquid in the tank, which carries much of it out of the tank, thus defeating in part the object of the process. Furthermore, the changes due to aërobic decomposition of organic matter appear to render the sewage rather more difficult to treat by processes of oxidation than fresh sewage which has not become impregnated with the gases and other products of decomposition. Septic sewage also frequently possesses an exceedingly offensive odour.

Two-storey Tanks.—A recognition of the defects in the septic process led to the construction of two types of two-storey tanks—one, by Dr. William O. Travis, of Hampton, England, and another by Dr. Karl Imhoff, of Essen, Germany. The theory upon which these types of tank are based is that the sewage should be allowed to pass through the sedimentation chamber as rapidly as is compatible with the practically complete removal of the suspended matter capable of settling in a reasonable length of time, and that the sludge should be permitted and encouraged to decompose in a chamber separate and distinct from that in which the sedimentation process is going on. The result of this plan is an effluent deprived of its suspended matter, and which has not come in contact with the decomposing sludge, and therefore does not contain the gases and other products of decomposition, nor the finely-divided suspended matter so prevalent in effluents from the septic tank. In fact, where sewage is rather dilute and the temperature is moderate the effluent from such tanks frequently contains dissolved oxygen. Sections of the Imhoff tank are shown in Fig. 2.

Work Performed by Sedimentation.—It may be assumed that of the 150 parts suspended solids capable of settling in two hours, perhaps 130 parts can be removed by efficient plain sedimentation. This is based on a tank efficiency of about 90 per cent, computed upon the removal of settling solids. Upon this assumption the effluent will contain suspended colloidal matter which, together with the remaining settling solids, will amount to about 170 parts per 1,000,000. In addition the effluent will contain about 500 parts of dissolved solids, of which about 50 parts has been classified as dissolved colloidal matter, 40 per cent of which may be assumed to be organic.

Chemical Precipitation.—If further improvement is desired a part of the remaining settling solids, suspended colloidal solids and dissolved colloidal substances may be removed. To accomplish this recourse was had many years ago to chemical precipitation. This consists of adding to the sewage certain chemicals like lime and sulphate of iron, which react upon each other in such a manner as to form a flocculent precipitate, which gathers in large flocculi which enclose and attract the finely-divided suspended matter and some dissolved colloidal matter, and by their weight carry these substances to the bottom. In this way it is possible to greatly reduce the suspended solids and to effect some reduction in the so-called dissolved matter. This method has been subject to much objection on account of cost, the difficulty of disposing of the large quantity of sludge produced and of the partial removal only of the organic matter contained in the original sewage. Chemical precipitation is generally utilised by itself, although in some cases, particularly in the treatment of industrial wastes, it may be introduced as an adjunct to and following plain sedimentation, and it may be used as a treatment preliminary to some method of filtration.

Sedimentation with Aëration.—The most recent development in the art of removing suspended and colloidal substances from sewage is that known as the "activated sludge process." By this means it is possible to remove from ordinary municipal sewage a large part of the suspended and colloidal matter. As yet the installations are experimental, but are giving promising results. Suspended solids may be removed almost completely in the remarkably short time of four hours, or even less. This process will be described in succeeding pages.

Work Performed by Sedimentation aided by Methods of Removing Colloids.—It has been pointed out that the effluent from efficient plain sedimentation will contain about 170 parts per 1,000,000 of settling and suspended colloidal matter, and about 50 parts of so-called dissolved colloidal matter, making a total of 220 parts per 1,000,000.

Several ways of removing a portion or the whole of this matter have been suggested, among which may be mentioned sedimentation in tanks equipped with many vertical slats, or colloiders, chemical precipitation and the activated sludge treatment. The last method will accomplish more than is practicable under ordinary working conditions by either of the others, and in addition it will at the same time oxidise some of the dissolved substances; therefore it cannot fairly be considered as simply a means of removing suspended and colloidal matter.

The most effective method devoted strictly to the removal of such substances is chemical precipitation, by which much of the settling solids and colloidal matter can be removed. In addition to the 130 parts of settling solids which may be removed by plain sedimentation, about 160 parts of the settling solids and colloidal matter which escapes this process can be removed by chemical precipitation, leaving in the effluent from this process 60 parts per 1,000,000, or less, of settling and colloidal matters. It is possible to go even further, but the cost of doing so has usually been prohibitive.

The effluent from sedimentation tanks may be discharged with propriety into some bodies of diluting water, but in many cases it is necessary to carry the process of purification further. Where chemical precipitation will provide a suitable effluent the choice between this method and some means of oxidation will depend upon their relative costs. In many cases, however, the effluent from chemical precipitation will not be adequately purified and it will be necessary to resort to an oxidation process. The failure of various tank treatments to remove fine suspended and colloidal matter and the necessity of oxidising the organic matter of tank effluents before their discharge into natural waters, led to the development of processes for transforming this organic matter into stable substances, the demands of which for oxygen are not great enough to exhaust the supply or cause putrefaction.

CONTACT BED TREATMENT.

Perhaps the most logical step ahead from tank treatment is the application of sewage to the contact-bed. Such beds are built in water-tight compartments filled with broken stone or other similar medium to which bacteria become attached. The mass of stone is thus converted into an active bacterial medium, over which the sewage gradually flows during the filling and discharging periods, and in contact with which it remains during the contact period.

Such beds are operated in cycles, of which the following is typical: –

Time of filling	1·0 hour
Time of contact	0·75 „
Time of emptying	0·25 „
Time of resting	6·00 „
Time of cycle	8·00 hour

While the sewage is in contact with the bacterial film or jelly surrounding the stones, its colloidal and dissolved substances are attracted to these films in which the bacteria are living and digesting the organic matter thus brought to them. The changes which occur in the contact-bed apparently consist of the initial removal of suspended and colloidal matters, its partial oxidation and the oxidation of matters in solution. By this process it is possible to so change the character of the sewage that even when undiluted it will remain stable, or, in other words, will fail to putrefy, and may therefore be discharged into streams or bodies of water much smaller than those into which ordinary sedimentation tank effluent could properly be discharged. The effluent, however, is usually turbid, contains some suspended matter, and is far from being fully oxidised. This process, which has met with some favour, both in this country and abroad, usually provides for two contacts, the sewage being applied to a secondary bed after it has remained in the primary bed during the requisite period of contact. Fig. 3 shows a typical double contact bed.

(To be concluded.)

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

GERMANS AND CREMATION.

To the Editor of The Surveyor.

Sir,—Apropos to the Germans and cremation, mentioned in your columns, "Things One Would Like to Know," August 11th, I find on investigation that the so-called society, "Friends of Cremation," are most active. We may not agree with many practices and principles of our foe, yet we cannot overlook the fact the Germans have long been in advance of ourselves in matters of sanitation. The Germans have long been strong believers in cremation, and although incineration was prohibited in Prussia, the population of this province frequently conveyed its dead outside the prohibited area to gratify its wishes.

When I think of the thousands of dead bodies buried within a few inches of the surface of the earth in Belgium and France, I am too horrified to dwell on what the future holds for these countries. Sentiment must be put on one side; the dead bodies must be totally destroyed, and the only means is by cremation. This is a matter which cannot be inquired into or discussed at the moment, but the future holds forth a serious question which these countries will have to face. Measures will have to be undertaken to prevent a second war in their midst—an outbreak of dread disease which will destroy thousands of the population and cause greater devastation than the sword.—Yours, &c.,

Albert C. Freeman.
Author, "Cremation in Great Britain and Abroad," "Antiquity of Cremation," &c.
September 1, 1916.

BRITISH AND AMERICAN MEASURES.

To the Editor of The Surveyor.

Sir,—As interesting to British engineering and commercial interests, would it not be well to remind your readers from time to time that the United States of America avoirdupois measure of 1 ton, when quoted simply as "a ton, and not specifically as "a ton of 2,240 lb.," is a ton of 2,000 lb. only?

Also that the United States gallon is a wine measure gallon, having a cubic capacity of 231 in. only, against the British cubic capacity of 277·463 in. per gallon.

In commercial affairs, when quotations are received *abroad* from a British and an American house, each quoting "per ton," or giving, say, the capacity of a pump at so many gallons, the foreigner is unconsciously (so far as he is concerned) often deceived into placing his order with the United States on account of the apparently cheaper tonnage price, or the apparently greater pumping capacity.

From wide personal knowledge obtained while touring foreign countries, the writer knows that this point deserves more consideration than it generally receives in Great Britain. Therefore, if you are in agreement as to the desirability of bringing these points to prominent notice occasionally, perhaps the publication of this letter will serve that purpose at present.—Yours, &c.,

C. T. Evennette.
London.
September 4, 1916.

THE MASKING OF STREET LAMPS.

To the Editor of The Surveyor.

Sir,—Considerable pains have been taken to obscure the light from our street lanterns, yet in every case I know of rays of light still fall on the ground beneath the lantern, which is illuminated in a manner far more readily seen by navigators of the air than any effect produced by horizontal rays.

The effect of obscuring the light from these lanterns has been to reduce their utility to that of pilot lights for the direction of traffic, an object which would be far better obtained were the lanterns rendered opaque with the exception of a disc 1½ in. in diameter in the centre of each vertical pane.

The disc would be far more apparent to traffic than the present diffused rays of light, while only horizontal rays would be emitted.—Yours, &c.,

C. H. Cooper, M.Inst.C.E.,
Engineer and Surveyor, Wimbledon.
September 1, 1916.

CAUSES OF TRAMWAY RAIL CORRUGATION.

The following statement as to the causes of tramway rail corrugation, which are listed in the order of their importance, has, states *Engineering Record*, been prepared by Mr. Mason D. Pratt, chief engineer of the United Railways and Electric Company, of Baltimore. It is based on twenty-five years of experience in the manufacture of rails and the construction and maintenance of track. Mr. Pratt states that this was submitted to the chief engineers of all the larger tramway systems in the country, and that, while their individual experience varied somewhat, the conclusions were substantially agreed to by those who had given the matter careful consideration. The causes are as follows: –

(1) Self-propelled cars.—Practically all corrugation occurs on electric tramways where all or a large majority of the cars are self-propelled.

(2) Girder or other rails having considerable vertical stiffness.

(3) Soft steel for rails.—The extent and depth of corrugation is in inverse ratio to the content of carbon and other hardening elements.

(4) Single type of cars in operation, particularly double-truck, four-motor equipment.—On tracks over which there is regularly operated a service of mixed types of cars, corrugation may appear from time to time, but unless some other feature (as for instance No. 3) is the cause, the corrugation will usually "iron out."

(5) Contour of rail head.—Flat-headed rails, or those on which the wheels have only a narrow or partial bearing, will develop corrugations earlier than those on which the wheels have a full bearing (as on convex-head rails).

(6) Heavy mill scale on the rails. On rails that have been rolled under conditions producing heavy mill scale that is allowed to go through the finishing pass, the surface of the rails has been so heavily marked as to start corrugation immediately after the rails have been put in service. Mr. Pratt has inserted the following clauses in his specifications for rails for the last two years, and this has had a beneficial effect: –

"In the rolling process such precaution shall be taken as may be necessary to entirely remove mill scale just prior to rails entering last two finishing passes and otherwise to produce a finished bar having smooth, regular and true surface on head and in finishing contact areas.

"Any rails showing by the closest possible inspection the slightest indication of corrugation will be rejected."

Other causes are: (7) Rapid acceleration and deceleration. (8) Unequal diameter of wheels on same axle. (9) Long radius curves. (10) Intensity of wheel loads. (11) Track foundation. (12) Segregation of steel. (13) Track sanding. (14) Grades.

Sewage Disposal and Water Supply in Canada.

RÉSUMÉ OF TREATMENT PROCESSES.*

The question of stream pollution is becoming very serious in Canada. As proof of this, investigation has shown that 183 municipalities in Canada dispose of their sewage in raw, untreated form, by discharging directly into inland water. This figure means about 66 per cent of the places that have any sewerage system at all. From most of these waters other communities draw their water supply, placing their intakes below the discharge outlet for sewage. It has been found that 40 per cent of the waterworks plants in Canada draw their supplies from sources that are possibly polluted. This indicates the extent to which the practice of stream pollution has developed, and the danger to which people are subjected through improper handling of sewage. The methods of sewage disposal and water supply are thus intimately related. In many instances municipalities have utterly disregarded the welfare of other places in the matter of discharging putrescible sewage into a source of water supply.

MORE INTEREST BEING SHOWN.

That this matter is receiving more of its due attention is evidenced by the increasing interest shown in this connection. Expenditures have been authorised for the construction of sewer systems and sewage purification works, and many plans are being prepared for more or less comprehensive lay-outs. All over Canada a greater realisation is being felt that a sanitary method of gathering and disposing of sewage waste is of paramount importance from a health standpoint alone.

On the other hand conditions may be such that a combination of methods may be advisable. The problem for the engineer is, then, to determine to what extent purification must be perfected and to design a method that will most effectually carry this out.

In the entire country only 279 communities have any method by which they remove their sewage. This is remarkably small in comparison with the total number of towns in Canada, due, no doubt, in part to the heavy expenditure which the construction of sewage systems involves. The capital lay-out necessitated is, in general, greater than smaller places care to spend.

In some places the method in use is to employ one set of sewers to carry domestic sewage, street drainage and storm overflow. In others separate systems are installed. One hundred and fifty-five towns employ the combined method, while separation is carried out in 124 places. By provinces the number of sewer systems is as follows: Nova Scotia, 20; Prince Edward Island, 2; New Brunswick, 10; Quebec, 98; Ontario, 95; Manitoba, 9; Saskatchewan, 15; Alberta, 14; British Columbia, 16.

The total length of pipe included in these systems is 4,223 miles.

Sewage treatment, with the object of rendering the effluent harmless and free from disease-spreading bacteria is carried out in only 75 cases, representing 36·3 per cent of all the municipalities which possess sewerage systems. The three maritime provinces have no purification systems at all, sewage in these cases being discharged directly into rivers or bays. The Western provinces show the greatest proportion of treated sewage works. In Saskatchewan, 80 per cent of all systems are treated; in Alberta, 43 per cent; in British Columbia, 44 per cent. In Ontario, about one-third of the towns purify their sewage, and approximately one-eighth in Quebec.

SEWER PIPES.

Sewage systems show no great variation as regards their distribution pipes. Tile pipes are the accepted standard for all small and many large installations. In the larger towns, where the size of the pipe-lines is sufficient to warrant it, brick and, to a lesser extent, concrete are freely employed as materials for sewer construction. Cast-iron and steel occur in rare instances. Wooden sewers have been installed in four or five towns. St. John, N.B., possesses 11¼ miles of this type in various sizes, and Winnipeg has 1¼ miles, while other places have lesser amounts.

Plants for the treatment and purification of sewage wastes show more variation in design and manner of operation, and very many systems have been evolved to carry out purification effectively. Local conditions, as well as initial cost, govern to a large extent the particular type which any town will select, and the degree of purification desired will determine the extensiveness of the system.

In the towns and cities in Canada which employ methods of treatment illustrations are afforded of practically every well-known process, from the simplest to the more extravagant. In many cases, where conditions warrant, a combination of systems is made use of, purification increasing with each step.

STERILISATION.

Two or three municipalities merely render their sewage sterile by means of chemical treatment with hypochlorite of lime. This is simply a disinfecting process, and does not aim at separating the solid materials from the liquids. The number of organisms is reduced to such an extent, however, that the discharge is not of exceptional danger. Bleaching powder is also used to sterilise the effluent from other purification processes, in this way rendering it non-putrescible, so that it can be safely discharged into a stream which is the source of water supply for another community.

Sedimentation methods are very often employed in Canadian towns. Chemical precipitation is sometimes made use of.

SEPTIC TANKS.

Septic tanks in some form or another are particularly popular. Of the seventy-five purification installations in Canada, forty employ this arrangement, either in conjunction with further processes or alone.

The Imhoff tank, used in several instances in Canada, is an improved septic tank, in which the sewage is allowed to pass through the sedimentation chamber as rapidly as the suspended matter can settle. The sludge decomposes in a chamber separate from that in which sedimentation takes place. This results in an effluent which has not come in contact with the decomposing sludge, and which does not hold the suspended matter common to effluents of the septic tank. Tanks of this nature are ideal for small communities, and their popularity is evidence of effectiveness for the purpose.

In eighteen cases extra treatment is involved, either in conjunction with or supplementary to the septic tank purification. In a number of instances the effluent is subjected to filtration to render it sterile. In others chloride of lime is used to accomplish disinfection. Very many of the towns have a combination of the septic tank arrangement, with filter beds of various types, as described below.

Examination of all of Canada's disposal systems shows that the septic tank exceeds all others in popularity. A large proportion of Western towns, in particular, are installing very modern and efficient methods.

WATER SUPPLY.

An increasing number of urban and rural centres of Canada are recognising the urgent necessity of a purer and more adequate water supply. This is due, no doubt, in part, to the rapid growth of large centres of population, coupled with the ever-increasing difficulty of keeping the sources of supply free from pollution.

That the municipalities of the Dominion are realising their duty to the public cannot be shown better than by the large money expenditures that are being made for this purpose at various points throughout the country.

Up to the end of 1914 approximately 523 municipalities had installed waterworks plants of one kind or another. Of this number 93 are treated, or 17·6 per cent.

It is interesting to note how these waterworks plants are distributed: Nova Scotia has 33; Prince Edward Island 3; New Brunswick, 20; Quebec, 177; Ontario, 166; Manitoba, 13; Saskatchewan, 30; Alberta, 33; British Columbia, 53. From springs or wells there are 206 municipalities supplied; from distant lakes or streams, 106; and from lakes or streams which are possibly polluted from one source or another, 216. Evidently, then, Canada should have at least 216 water purification systems, instead of ninety-three.

Of the ninety-three water purification plants, seventy-two use some form of filter and the remaining

* From the Toronto *Contract Record*.

twenty-one use hypochlorite of calcium. There is one exception—Longueuil, Quebec—where calcium hyposulphite is substituted. There are also a small number of municipalities where sedimentation or settling tanks or basins are in use—some as the only means of purification, others merely as auxiliaries to further purification methods.

Some of these sedimentation basins are natural reservoirs utilised at little expense. Others are rectangular basins with horizontal walls, varying in depth and size, depending on the condition of the water and the quantity demand. Where it can be had at small expense, a settling basin is generally considered a valuable adjunct of any purification system.

FILTERS.

The Canadian filtration systems include everything from a natural sand and gravel "soakage" to the most modern mechanical or rapid filtration system. At Claresholm, Alta., for example, is a good example of the former, where the water is drawn through a gravel bed and taken out at a point 150 ft. distant from the river. At Pincher Creek, Alta., the water also is drawn through the gravel bank of a creek. In Redcliff, Alta., the water passes through 2,000 ft. of gravel. At Red Deer, Alta., the wells from which the water is pumped are provided with cinder filter-walls.

A considerable number of municipalities also combine some form of chemical treatment with their filtration, the particular chemical used depending on the condition of the water. Most frequently the water is first treated with chloride of lime; aluminium sulphate and ferrous sulphate are also used. In St. Catharines, Ont., the method of purification consists of a sedimentation basin, supplemented by treatment with chlorine in the liquid form.

BUILDING WORK IN JOHANNESBURG.

By G. S. Burt Andrews, M.Inst.C.E., M.I.Mech.E., Town Engineer.

[Extract from report for year ended June 30, 1915.]

Soon after the year under review began, the outbreak of the great war in Europe caused an immediate stoppage of many projected works and a cessation of the preparation of any new schemes. The consequence of this disturbance resulted in such a decrease in building that the returns touched a lower point than at any period since the resumption of activity after the Peace of Vereeniging in 1902. The monthly decrease indicated amounted to fully 75 per cent—*i.e.*, only about one-quarter the usual amount of work was being executed.

This continued for several months—till the effect of the victory of the Marne, the suppression of the South African Rebellion and the success of the campaign in South-West Africa caused a revival of confidence. Since then there has been a gradual recovery towards normal conditions, and at the close of the year the usual amount of work had practically again been reached.

Although the progress of the town has been disturbed, as indicated, by the great European War, there is still a good deal of growth noticeable, and the commercial and industrial centres in East Market-street and Newtown have continued to show activity, and some new buildings have been erected. Dwellings are still being erected in large numbers, the total during the year being 458.

The tendency has been to open up new districts in outlying parts, with a consequent depreciation of districts near the town. This number of dwellings is only half of that put up during the previous year, and is entirely due to the great war. The houses are more comfortable and better fitted up than during the previous periods, it now being the exception not to have hot water and electric light. There is a large indication that the succeeding year will show considerable improvement on the year just passed, as it is known that the conservative dealings with loans on buildings has been bearing the building market by the comparative stoppage of advances.

Non-combatants for Road Making.—From H.M. prison, Lewes, forty-one non-combatants were released last Friday and sent to Newhaven for road making.

Steam Haulage.—The Metropolitan Asylums Board have bought a road train, comprising steam tractor and three 6-ton trailers, so that it can do its own haulage from railways to asylums.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that the important committee which has recently been formed to investigate the question of the action of sea water on cast-iron will lead to some definite results with regard to this rather obscure matter? Was it not a wise decision to fix Brighton as the place for these investigations instead of Liverpool, where hitherto certain investigations have been conducted, but where the investigators were somewhat handicapped by having to cart the sea-water in tanks for a considerable distance?

* * * *

When will the question of the waste of water that is always going on be seriously considered and arrested? Do we not read that in nearly every city and town in the country complaints are general as to the huge quantity of water that is daily passed through the service mains? Has it not been proved over and over again that a daily supply equal to 25 gallons a head of population is more than sufficient, and is it not much to be regretted—particularly at the present time—that greater care is not exercised in the use of this costly product?

* * * *

Could not the excellent example of the Surrey Council in placing seats by the sides of some of the public roads be followed by other authorities, especially now that there are in our midst so many wounded soldiers who cannot walk far without a rest? Would some ridiculous red-tape department surcharge an authority which spent money in this direction?

* * * *

Are there existing any statistics or records which confirm the statement which is now somewhat generally accepted that tar-dressing the surface of a road adds exactly 33⅓ per cent to its life? Does this refer to an ordinary water-bound macadam road, or to a bituminous-bound road, or to both? If this is an established fact, should not the practice of tar-dressing become universal on the score of economy?

* * * *

Is not the sixth annual report of the Road Board extremely interesting reading, especially the Appendix 15, which is a report by the engineers to the board of the trials of certain road materials on the "road machine" which was installed there some years ago? Although it may be a little disappointing to find that only "carpets" were tried, are not the results of four trials of different mixtures given on Table I. in that report of considerable significance, especially when one of the "samples" stood a test equal to 458,200 tons per yard width before reaching the point when "excessive vibration" was reached, whereas another sample almost of the same construction, except that the "filler" was blue lias lime instead of Portland cement, only reached 25,960 tons before excessive vibration was reached? Would it not have been useful if an additional column to the table could have given the approximate cost of each material per square yard?

* * * *

Is it not evident that pressure filters will take the place of gravity sand filters in many new and existing water schemes? Have not the improvements and additions lately made to these mechanical filters rendered them capable of dealing with organically polluted water quite as efficiently as they formerly dealt with discoloration and inorganic impurities? But, like most other sanitary "fittings," do they not always require intelligent supervision and care? Has not the Local Government Board's withdrawal of some of the restrictions formerly placed on these filters removed some of the obstacles to their installation?

* * * *

Did the tests which were recently carried out at the Massachusetts Institute of Technology with regard to the resistance to traction of different classes of road surfaces add much to our present knowledge? Did not these experiments show that for non-resistance to vehicles with solid tyres the following was the order: Asphalt, wood blocks, brick paving, tar-macadam, ordinary water-bound macadam, heavily oiled macadam, granite setts? Is it not possible that some of these results might have shown a different order of merit if pneumatic-tyred wheels had been employed, especially as regards granite setts?

Law Notes.

Edited by J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed. All explanatory diagrams must be drawn and lettered in* black *ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. Unless these conditions are complied with we cannot undertake to reply to queries.*

Substitution of Water-closet for Pail-closet: Work Done by Local Authority: Damage to Premises Liability.—An important point in connection with the subject of the substitution of water-closets for pail-closets was decided by the Court of Appeal in *Place* v. *Rawtenstall Corporation*. This was an action to recover damages awarded to the plaintiff by an arbitrator for injury to his house. The facts were as follows: The corporation served notice on the plaintiff requiring him to convert his pail-closet into a water-closet, and connect the same with a sewer, within twenty-eight days. The notice not being complied with, the corporation proceeded to carry out the work themselves. For this purpose they constructed a joint sewer to carry away the sewage from the plaintiff's house and several other buildings, at a total cost of £54, of which the plaintiff's share was £11. He refused payment, on the ground that in the carrying out of the work his house had been injuriously affected by subsidence, for which he claimed damages. The matter was referred to an arbitrator, who awarded the plaintiff £46 damages and £62 12s. for taxed costs. The corporation, however, denied liability under sec. 257 of the Rawtenstall Corporation Act, 1907, which provides as follows: "Whenever the corporation, or the surveyor, under this Act, or any general or local Act, or any by-law for the time being in force within the borough, execute, or execute or alter any work, or do any act or thing in default or at the request of the owner, occupier, or other person required to do such work, act or thing, the corporation shall not, as between themselves and such owner, occupier, or other person, in the absence of negligence on the part of the corporation or the surveyor, or of any contractor, or other person employed by them or him, be liable to pay any damages, costs, charges or expenses for or in respect of, or consequent upon the executing . . . of such work . . . and any such damages . . . paid by the corporation . . . shall be part of the expenses payable by such owner, occupier, or other person, and shall be recoverable accordingly." Mr. Justice Ridley gave judgment for the plaintiff, and the corporation's appeal from his decision was dismissed with costs. Mr. Justice Scrutton, in delivering judgment in the Court of Appeal, said that inasmuch as sec. 257 took away the ordinary right of the owner to be paid for damage to his premises by work done by another, it must be construed strictly against the corporation, in favour of the person whose common law right was taken away. The pipe which had been laid along the plaintiff's passage was sufficient to conduct the sewage or rain water of eight or nine houses. It was not therefore, in the words of the section, work in respect of which the plaintiff was "in default," and the damage did not result from the failure to perform "such work" by the plaintiff, as that work was defined by the notice. It was correct, no doubt, to say that it *included* the work which the plaintiff should have done, but it also included much more, and there was no finding that the damage caused was caused solely by the work which the plaintiff had received notice to do. For these reasons it appeared that the corporation did not bring themselves within the clause intended to exempt them, in the absence of negligence, from a claim for damages arising from the fact that they had done the work which the person served with a notice had failed to do himself; and they remained therefore under the ordinary liability at common law to make good damage done to the property of another.

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as nom de plume. *The letter* X, *combinations such as* X.Y.Z., *and words such as "engineer" and "surveyor," should never be used.*

Water Main: Damage to Highway. "T. E. T." writes: The Metropolitan Water Board supply water in this district. A burst occurred recently in one of their mains in the highway, and part of the escaping water found its way under the adjoining footpath, about 8 ft. distant, and raised the concrete slabs, making the path dangerous. The Water Board sent an order to the surveyor of the urban district council to make good the roadway when they opened up to repair the burst, and to charge them with the cost, but declined to issue an order to repair the footway, stating that it was the duty of the council. I shall be glad to have your opinion on the latter point, and to know if any similar cases have been before the High Courts.

This is rather a difficult question. I do not know of any case in which a similar point has been decided, but, if it can be proved that the burst was due to negligence in the construction or repair of the main, I think the Water Board would probably be held liable.

Building By-laws Roof. "Domus" writes: The owner of a dwelling-house in this district, which was constructed before the urban district was constituted, and at a time when there were no building by-laws in force in this district, proposes to remove the slates from the roof of the house, and substitute patent roofing material which I consider is not strictly incombustible, and would therefore not be in accordance with the present building by-laws. Can you inform me whether my council have any power to prohibit the use of this unsatisfactory material on houses which were constructed prior to the confirmation of any building by-laws for this district?

I do not think the council have any such power, except in a case in which the alterations to the building are so extensive as to constitute the erection of a "new building" within the meaning of the by-laws.

Tar-Spraying.—"W. J." writes: Most of the principal roads in this district have been tar-sprayed some weeks ago, the tar being thoroughly soaked in. The basalt chipping put on at the time is worn down, and the roads have now a good smooth surface. Do you think that the council would be liable for damages arising from a horse slipping down on the smooth surface in dry or wet weather, and whether negligence could be proved against the council by the absence of sanding and gritting this smooth surface from time to time?

Assuming that the work was properly carried out, and the surface made reasonably safe for traffic either in dry or wet weather, I do not think that the council would, in ordinary circumstances, be liable for damages arising from a horse slipping. But in the event of special weather conditions rendering the surface less safe than usual, I think it would be a wise precaution to sand or grit the roads, as the omission to do so at such times might possibly be construed as evidence of negligence.

Erratum. In reply to query by "H. C.," p. 149 *ante*, line 5, for "section" *read* "erection."

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

Dampness in House Walls.—When the interior of a house wall is discoloured through dampness the trouble may possibly spread and cause much expense. Instances are known where the plaster and the woodwork have perished through humidity. We hear that a house in Leicester which previously was exceedingly damp, was rough-casted with Pudloed cement two years ago. The architect and his client both expressed their satisfaction with the change that has taken place, and the makers of Pudlo inform us that they can refer to several hundred similar cases.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Brighouse T.C.—It is proposed to build a new coal store at an estimated cost of £2,500.

Chertsey R.D.C.—The engine-house extensions at Byfleet sewage disposal works have been completed at a cost of £741, less than the estimated cost by £28.

Manchester T.C.—Plans have been approved for the enlargement of the transformer house at the Stuart-road electricity works.

HOUSING AND TOWN PLANNING.

Weardale R.D.C.—The county council have advised the rural council to prepare a scheme for workmen's houses.

MOTOR TRANSPORT.

Acton U.D.C.—The council have purchased a new motor fire engine.

Flaxton R.D.C.—At the next meeting of the council the surveyor, Mr. J. W. Lupton, will submit a further report on the cost of steam haulage by motor tractor and tipping wagons.

Glasgow T.C.—It has been agreed to purchase two 5-ton battery-equipped wagons, at a cost of £2,990, one each from Edison Accumulators, Limited, and the General Vehicle Company, Limited.

REFUSE COLLECTION AND DISPOSAL.

Nottingham T.C.—The council are recommended by the Health Committee to apply to the Local Government Board for sanction to the raising of a sum of £6,201 for the purchase of additional land for the purposes of a refuse depot at Radford.

ROADS AND MATERIALS.

Aberdeenshire C.C.—The Turriff District Committee have agreed to an estimate of £4,025 for the upkeep of the roads, being the same as last year. Last year £2,122 was expended on the roads, or £2,388, including expenditure on tools and steam plant, and there was a balance on hand of £1,375.—The Deeside District Committee have invited the wood merchants and the local landowners to a conference on the damage done to roads by timber haulage.

Barnard Castle U.D.C.—The council are considering the representations of the county council with respect to the improvement of the main roads in the rural district.

Belfast T.C.—The arbitrator in the matter of the acquisition of ground for widening Halliday's-road and New Lodge-road has fixed the amount of compensation to be awarded at £235.

Belper U.D.C.—The tender of Messrs. W. Weeks & Son, at £56, has been accepted for the supply of a tar-sprayer.

Buckfastleigh U.D.C.—The surveyor, Mr. L. M. Williams, reports having completed 13,566 yds. of tar-spraying, at a cost of 1·04d. per yard super.

Chelmsford T.C.—The Local Government Board have sanctioned a proposal to defray out of the unexpended balance of the housing scheme loan the cost of making up stone footpaths between the council's blocks of houses.

Dumbartonshire C.C.—Plans and estimates have been submitted to the Western District Committee of the proposed improvement on the Gareloch and Loch Long road between French Riggs and Morelaggan. The cost, including engineering and inspection, was estimated at £6,500. The plans had been drawn up with the view of their being forwarded to the Road Board so that a grant may be received for the proposed work as soon as circumstances permit. The plans were approved. The road surveyor's annual report, specification, and estimate were submitted. The estimated expenditure to be provided is £13,672.

Eastbourne T.C.—The borough surveyor, Mr. A. E. Prescott, reports that the full scheme and estimate of the coastal road has been prepared. The expenditure in connection with the scheme will be heavy, probably £150,000. As to the advantage of a new road there could be no question. The existing road was extremely narrow, and, combined with the numerous sharp bends and corners, it was an absolute danger to users. Mr. Prescott adds: "The carrying out of this scheme would provide work for many of our men after the cessation of hostilities. I have several schemes of necessary road widenings and other public improvements already prepared to make provision for the employment of many of our men on their return, but I am most hopeful that the proposed coastal road scheme will be given preference, as we should obtain good value for the labour employed, and the results accruing would be of immense value and lasting benefit to the towns concerned."

Frome U.D.C.—The surveyor reported at the last meeting that the county surveyor had consented to the use of limestone on certain roads in the town, because he was satisfied that there was no stone of the better qualities available.

Hailsham R.D.C.—A report of the Roads Committee, presented at a meeting of the council on Wednesday, stated that the work of road tarring was within a few days of completion; 580 barrels of tar had been used, and about 16,000 sq. yds. of road surface covered. The approximate cost would be about £715. The cost of the work had been about 20 per cent per unit higher than was the experience last year, owing to the higher cost of materials and team labour, and the unfavourable weather that had prevailed. It had been found impossible to obtain extra men, and as the permanent staff of road men was reduced by three in April, it had been necessary to draw road men from distant sections to carry on the work, with the consequence that much of the ordinary work in their own sections had been left. On the other hand, the saving in wages during the five months had been considerably over £100.

Horncastle R.D.C.—Only one tender having been received for steam rolling for seventy days—viz., the Eddison Steam Rolling Company, Limited, at 20s. 11d. per day—it was decided to accept this subject to the firm agreeing to bear the expense when the roller is standing for wash-out purposes.

Kidderminster R.D.C.—The surveyor, Mr. G. J. Shepherd, informed the council that it was getting extraordinarily difficult to carry on the work of the district. There was a great scarcity of labour, and it was impossible to get teams to work. There would be a very much increased cost in keeping up the roads.

Milngavie T.C.—It was reported that the transfer of the control of the town roads from the county council to the town council had resulted in a considerable saving.

Newark R.D.C.—The surveyor, Mr. R. Oakden, has received instructions to confer with the engineer to the Road Board with a view to obtaining a grant for the reconstruction of the Lincoln road. The expenditure involved in the scheme is estimated at £5,000.

Newton Abbot U.D.C.—The council have approved plans for making up roads at the back of Deer Park-road and Kingskerwell-road.

West Hartlepool T.C.—With regard to the Local Government Board circular on public works after the war, Major Martin urged that the council should submit the scheme for a new road to the North, *viâ* Easington, which was under discussion prior to the war. He believed the Government would be prepared to advance large sums of money for works of that description. The town clerk promised to communicate with other authorities interested in the scheme.

SEWERAGE AND SEWAGE DISPOSAL.

Manchester T.C.—Plans have been approved of new sewerage works in Gorton-lane and Napier-street. Drainage works will also be carried out in Mosley-street.

Plymouth T.C.—The borough engineer, Mr. J. Paton, reporting to the Works Committee on the upkeep of the main drainage system, states that flood water had issued from a number of manholes recently. It was reported that, in addition to causing inconvenience, the flooding impeded the tramway traffic, and often damaged the motors of the tramcars. It was decided under the exceptional circumstances to ask the Local Government Board for sanction to borrow £1,500 for the purpose of constructing a sewer of sufficient dimensions to take off the flood water.—It was agreed to increase the wages of the sewer men engaged at the sewage works at Devonport from 24s. to 26s. per week, and that the other men at Devonport engaged on work in the sewers should be paid on the same basis as the men employed on sewer work in the Plymouth area, as follows: Leading sewer men 7½d. per hour instead of 28s. per week; other men 7d. per hour instead of 26s. per week. Applications were also received from three paviors for increase of wages, but these were declined.

Rotherham R.D.C.—The surveyor, Mr. B. Hey, reported that one of the filter beds at Swallownest sewage works had cracked, necessitating wrought-iron strips being placed round it. He had endeavoured to trace the cause, but had not been successful, as coal had not been worked anywhere near the site for thirty years. He was instructed to take what steps might be necessary for safeguarding the filter bed for the present.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—It was reported that the new system of lending cooking apparatus was giving great satisfaction. Prepayment meters had proved a marked success. They now numbered 14,000, and brought in £100 a day.

Altrincham U.D.C.—A report has been received of the collapse of the negotiations for the purchase by the Manchester Corporation of the North Cheshire Water Company undertaking, owing to the Hale Urban District Council objecting to a temporary rise in the charges. It will therefore become necessary for the company, in order to meet the demand for an increased supply in its area, to endeavour to raise additional capital and to purchase water from the Manchester Corporation at a much higher price than has formerly been paid for it. The Altrincham Council, in receiving the report, expressed regret at the failure of the negotiations.

Belfast T.C.—It has been agreed to replace eight mechanical stokers at the electricity station by four stokers of an improved pattern.

Branston R.D.C.—A scheme has been agreed to for a water supply to Waddington, at an estimated cost of from £1,800 to £2,000.

Daventry T.C.—The tender of Messrs. Timmins & Co., of Runcorn, at £120, has been accepted for overhauling and repairing the water-pumping plant at Dodford.

Hammersmith B.C.—The electricity undertaking is reported to be on a satisfactory basis in spite of war conditions. The surplus revenue made a further contribution of £3,450 towards the relief of the rates. No increase has been made to consumers for current supplied, and it is hoped that it will be possible to continue this policy.

Ilford U.D.C.—A deputation has been appointed to a conference of borough councils to discuss the question of linking up electricity undertakings.

Kirkcaldy T.C.—A new and important development is reported to have arisen in regard to the Kirkcaldy Corporation electricity works. Mr. Francis, burgh electrical engineer, has submitted a report on the capacity of the present works and the recent applications for a large supply of power by one of the largest and most important firms in the burgh. This the corporation cannot supply with the present installation. The Fife Power Company is willing to enter the burgh and supply the power, but is prevented by a clause in the private Act of Parliament. The town clerk in a statement observes that the company practically ask that the section referred to be abandoned by the corporation. This demand he regards as a serious matter, and he considers it clearly foreshadows the promotion by them of a Provisional Order. While he felt sure the town council would receive fair treatment from Parliament, they should take care that they, on their part, were able to show the committee that they had done all that was reasonable.

Maidenhead T.C.—The Electric Lighting Committee in reporting that the Diesel engine was now running, said that great credit was due to the staff for the work done in connection with the overhauling of the engine.

Ripon T.C.—The city council have appointed Mr. George Wilkinson, electrical engineer, to prepare the necessary plans and particulars for obtaining a Provisional Order for a scheme of electric lighting for the city.

Rotherham R.D.C.—The clerk has been instructed to apply to the Local Government Board for powers to borrow sums as follows: Bramley £275, Maltby £665, Ravenfield £102, Wickersley £328; being the amounts required in excess of the original loan of £14,889 in respect of water supply for these and other places.

MISCELLANEOUS.

Southport T.C.—The General Purposes Committee have agreed to recommend that all employees previously in receipt of the 2s. per week war bonus shall receive 3s. per week war wages—the term "war wages" being used in preference to "war bonus." These are the employees whose standing wage did not previously amount to 30s. per week. To those in receipt of 30s. and upwards the committee recommend a war wages advance of 2s. per week. The sum involved is equivalent to a 2d. rate. The committee further agreed to make an allowance to corporation workmen who have enlisted in the Voluntary Training Corps in the event of their being called up, so that they will be getting a sum equal to the extent of their ordinary wage under the corporation.

PERSONAL.

Captain Langshaw, ferries manager to the corporation of Birkenhead, has had his salary increased from £500 to £550 per annum.

Mr. J. Ennals, highways surveyor to the Lexden and Winstree Rural District Council, has been appointed plans surveyor to the council.

Mr. Joseph Hedges Barford has been appointed acting borough surveyor of Maidenhead in the absence of Mr. P. Johns on military duties.

Mr. H. D. Davies, chief electrical assistant of Stockton-on-Tees, has been appointed electrical engineer and tramways manager to the Heywood Corporation, at a salary of £200 per annum. There were about fifty applicants. Mr. Davies is thirty-five years of age, and has been at Stockton five years. For nine years previously he was at Darlington.

KILLED IN ACTION.

Private Reginald Herbert Butterfield, of the Cameron Highlanders, and eldest son of Mr. and Mrs. W. P. Butterfield, of Rose Villa, Menston, is reported to have been killed. He was in his twenty-fifth year, and prior to the war was with his father, who carries on business under the style of W. P. Butterfield, Limited, galvanising tank works, Lower Holme, Baildon. Private Butterfield, who had been at the Front about six weeks, enjoyed the high respect and esteem of a large circle of friends, who will deeply grieve to learn of his death.

A Remarkable Accident.—On Wednesday night a labourer, who was passing along the street in Hebburn-on-Tyne, placed his hand on a lamp standard, and was drawn around the standard by the electric current. When he was released he was dead.

An Official's Honorarium.—At Wednesday's meeting of Liverpool City Council, Sir Charles Petrie, referring to a decision of the Health Committee to return an honorarium received by them from an official of that committee, remarked that the official in question, whose salary was £450 a year, had agreed that any money received by him from the University or the Munitions Committee should be returned to the corporation. He had sent a cheque for £60, which was half a year's salary from these sources, to the Health Committee, and the committee had passed a resolution that the cheque be returned to him. They might have many similar cases, and they would probably have to do the same thing all round. That being so, he (Sir Charles) suggested that the Health Committee should take the matter back for further consideration. Alderman Muirhead (chairman of the Health Committee) assented to this course.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Bolton T.C.—£4,130 for the installation of a benzol plant, and £2,500 for the production of concentrated ammonia.

Halifax T.C.—£600 for a new water main.

Leiston U.D.C.—£1,000 for a cemetery chapel.

LOANS SANCTIONED.

Barnack R.D.C.—£224 for a water supply for Stibbington.

Battersea B.C.—£3,728 for electricity extensions.

Walthamstow U.D.C.—£9,610 for the extension of the electricity generating plant.

TRADES UNIONISTS AND HOUSING.

BIRMINGHAM CONFERENCE RESOLUTIONS.

Delegates to the Trade Union Conference which opened at Birmingham on Monday were present in considerable numbers at a National Housing Conference called by the Workmen's National Housing Council to consider the housing of the working classes.

In the course of the proceedings unanimous approval was given to the following resolution:—

"That, as it is impossible for local authorities to frame housing schemes that fulfil modern requirements, especially accommodation, that can be let at a rental within the means of wage-earners, this conference calls upon the Government to assist local authorities by contributing money from the National Exchequer equal to not less than 20 per cent of the sum sanctioned by the Local Government Board for the provision of housing schemes, and urges that not less than £20,000,000 should be set aside for housing purposes; and further demands that, in view of the reluctance of the local authorities to prepare housing schemes, the Local Government Board shall issue a special order making it compulsory on local authorities to exercise their powers under the Housing Act, so that schemes can be proceeded with immediately after the termination of the war."

The following resolution was also carried:—

"That this conference, representative of all sections of the working class, emphatically protests against the suggestion that public money should be used to assist limited liability companies and private owners to build houses that will be let at rentals based on the ordinary laws of supply and demand."

In a further resolution the conference condemned block and tenement dwellings as prejudicial to health and comfort.

FOR OTHER ADVERTISEMENTS
See End of Paper.

FLINTSHIRE COUNTY COUNCIL.
Applications are invited for two positions as Steam Roller Drivers under the above Council. Applicants must be legally exempt from Military Service. Wages at the rate of 32s. per week, with War Bonus allowance in addition. Apply, stating age, experience and qualifications, to the County Surveyor (Mr. Sam. Evans), County Offices, Mold, North Wales. (3,087)

ARCHITECT AND ESTATE AGENT'S OFFICE.—Capable Manager wanted; ineligible for military service.—Apply, stating terms, to Box 1,583, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,088)

JUNIOR ASSISTANT (22 years), ineligible, seeks position in Surveyor's office. Levelling, tracing and designing; clerical work if desired. Good references.—Box 1,581, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,085)

SCARIFIER.—Wanted, a Good Second-hand Independent Scarifier, "Thackray" or other type.
Will exchange Morrison if desired.
J. ALEXANDER GREEN,
Surveyor.
(3,086) Eckington, Sheffield.

EASINGWOLD WATER SUPPLY SCHEME.

THE RURAL COUNCIL AND THE ENGINEERS.

An engineers' claim against the Easingwold Rural District Council was discussed at the council meeting recently upon a motion by Mr. Wright: "That the resolution passed on June 2nd in reference to counsel's opinion on this matter be rescinded, and that the engineers, Messrs. Fairbank & Son, be furnished with a copy."

The clerk stated that Messrs. Fairbank were asked by the council to prepare a scheme for what was known as the water level. The work had not been proceeded with owing to the war, but Messrs. Fairbank, whose preliminary fees had been paid, claimed £198. The council had obtained an opinion of counsel on the matter, and it was against Messrs. Fairbank's contention. It was decided that Messrs. Fairbank should not see the opinion of counsel.

Mr. Wright, in moving the resolution, said that Messrs. Fairbank & Son had served the council well for a number of years, and it was only a matter of courtesy that the council should let them see counsel's opinion. It would not hinder the council in any way whatever, and it would be a source of satisfaction to the firm.

After the motion had been seconded,

The chairman (the Rev. H. B. Drew) said he thought it would be a great mistake to rescind the resolution. After they had decided on a course of action, unless some fresh circumstances arose, they ought to adhere to their decision. If he (the chairman) was likely to have trouble with anyone, he did not think he would be inclined to show his adversary his hand.

Mr. Clarke said the matter was a question of principle.

The Rev. A. T. Icely said that it seemed to him that what they wanted to come to was a right, honourable and just conclusion. Every bit of information should be put before both sides to enable them to come to such a decision. He proposed, as an amendment, that each side should furnish to the other copies of their respective counsel's opinion, in the hope that some compromise might be arrived at.

The amendment was not seconded.

The clerk said that Messrs. Fairbank based the claim on the Engineers' Association regulations, which said that if they did work on which a public inquiry was held, and for some reason the work was not carried out, they were entitled to half the commission. Messrs. Fairbank sent in a bill for that amount, and the council had not paid it.

Ultimately Mr. Wright's motion was lost, and it was decided that Messrs. Fairbank should not be allowed to see counsel's opinion.

New System of Building Construction.—Mr. P. C. Smith, the burgh engineer of Dunfermline, reported to a meeting of Dunfermline Dean of Guild Court on Tuesday that Mr Walter Wilson, clerk of works, Dunfermline, had drawn his attention to a new system of building construction which he had patented. The new method was altogether foreign to anything which the Court had experience of, and it was outside the four corners of the Burgh Police Act. From what he had seen, however, he was satisfied that the method was a departure for the better in the way of cheapening construction. He recommended the Court before the patentee had submitted plans to visit the yard and see the models. The Court assented to the suggestion.

Association of Managers of Sewage Disposal Works.—A meeting of the Metropolitan District will be held at the sewage farm, Sutton, Surrey, on Saturday, the 16th inst. Notes on the sewage disposal and purification works will be submitted by Mr. W. H. Grieves, engineer and surveyor to the council. The members will meet at the municipal offices at 3 p.m., where they will be welcomed by the chairman of the council, Councillor J. Wakeford, J.P. After the meeting the members will proceed to inspect the sewage disposal works in Clensham-lane. The objects of interest are: Septic tanks, double contact beds, five percolating filters with revolving distributors, sludge drying beds, refuse paper baler, and general machinery. The chairman of the Farm Committee, Councillor R. W. Wootten, will formally turn on the sewage to the new 66-ft. sprinkler, supplied by Messrs. Ames Crosta Engineering Company, Limited (filtering media supplied by Mr. Frank Keep). Tea will be provided at the sewage works about 5 p.m.

ROAD MAINTENANCE IN BERKSHIRE.

EXTENSIVE DAMAGE BY HEAVY TRAFFIC.

The report of the acting county surveyor, Mr. A. Langston Yockney, for the year ended March 31st last, states that the Berkshire roads have continued to suffer very considerably from heavy traffic, especially the principal trunk roads, such as the Bath road, Reading, Ascot and London road, Reading and Oxford road, Newbury and Oxford road, and the Reading and Eversley road. The result is that the macadam sides have been in places completely worn down. The Tarmac has also suffered to some extent, but as a whole has withstood exceptionally well the enormous increase in this heavy traffic, and the council can still be congratulated on the success of the reconstructed roads. Mr. Yockney thinks it unfortunate that Berks, a purely agricultural county with a low rateable value, should be so situated geographically that it has to take all this traffic whilst many other counties are, generally, getting less than their ordinary traffic.

In addition to this extraordinary traffic, during the year a great number of motor omnibuses have been running on the roads, and new services are being started and existing routes extended.

The Basingstoke road and the Reading-Shinfield-Eversley road have also been badly damaged by the haulage of timber.

Several lengths of road have suffered from the recent high floods and springs, and considerable sums will have to be expended in repairs.

The cost of road material (granite, limestone, slag, &c.), which has to be imported into the county, still increases. In many instances the cost of carriage is more than double the cost of material.

For the greater part of the year the council have been without the services of Capt. J. F. Hawkins, R.E., the county surveyor. Since, however, he has been home on sick leave from Gallipoli, and his subsequent appointment on the staff at the War Office, Mr. Yockney, it appears, has had the benefit of his advice from time to time.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

District Chairman—Mr. J. S. Pickering, M.Inst.C.E., Borough Surveyor, Cheltenham.

SOUTHERN DISTRICT MEETING.

A Southern District meeting is to be held at Bristol on Saturday, September 16th.

PROGRAMME.

11.30 a.m.—Assemble at the Council House.

District Meeting.

Election of District Committee.

Informal discussion on papers describing works to be visited.

1 p.m.—Luncheon at Stuckey's Restaurant. (Tickets 2s. 6d. each.)

Drive to the Suspension Bridge, Clifton and Durdham Downs, Eastville refuse destructor, Barton Hill Baths, inspecting *en route* six sections of bituminous road construction laid during the last four years. (Tickets for conveyance, 3s. each.)

6 p.m.—Tea at Stuckey's Restaurant by invitation of the city engineer.

F. R. Phipps,
Hon. District Secretary.
Borough Surveyor,
Basingstoke.

District Chairman—Mr. J. P. Wakeford, M.Inst.C.E., City Engineer, Wakefield.

NORTH-EASTERN DISTRICT MEETING.

A North-Eastern District meeting is to be held at Wath-upon-Dearne on Saturday, September 30th.

PROGRAMME.

10.15 a.m.—Meet at waterworks pumping station, adjoining Wath-upon-Dearne (G.C.Rly.) Station, and five minutes' walk from Wath-upon-Dearne Midland Station. Proceed to inspect the plant.

10.30 a.m.—Walk alongside the G.C. Railway to the new sewage disposal scheme in course of construction.

10.45 a.m.—Proceed to inspect the sewage disposal works.

11.30 a.m.—Proceed by motor 'buses from near Messrs. Stanley's oil works at Commonlane, along the main road *viâ* Barnsley-road and Brampton to Wath Wood reservoirs to inspect works there recently carried out. *En route* inspections will be made of the public baths, mortuary, sections of Tarmac roads, and private street works.

12.45 p.m.—Leave reservoirs by motor 'bus.

1 p.m. Lunch at the Red Lion Hotel.

2.15 p.m.—Proceed to town hall, where the institution will be welcomed by the chairman of the urban district council, Councillor Chas. Adkins, J.P.

Business:

(1) Minutes of last meeting.
(2) Correspondence.
(3) Election of executive committee.
(4) Any other business.
(5) Orphan Fund and support from N.E. District.
(6) Paper on "Notes of Municipal Works and Statistics in the Urban District of Wath-upon-Dearne," by Mr. J. H. Drew, M.Inst.C.E.I., M.R.San.I. (Member), engineer and surveyor to the urban district council, Wath-upon-Dearne, will be discussed.

5 p.m.—Tea at the Red Lion Hotel, by kind invitation of County Councillor Richard Payne, member of the Wath-upon-Dearne Urban District Council.

In order that the necessary arrangements may be made, members intending to be present must give notice of their intention not later than Monday, September 25th.

MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL MEETING PROGRAMME.

The annual meeting of the Municipal Tramways Association will be held at the Surveyors' Institution, Westminster, on Thursday and Friday, September 21st and 22nd.

The proceedings will open at 11 o'clock on the Thursday, when Mr. Peter Fisher, general manager of the Dundee Corporation Tramways, will deliver his presidential address.

The following papers will be submitted for discussion:

"Some Notes on Passenger Transportation in Large Cities," by Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways.

"Utilisation of Tramways for Goods Traffic," by Messrs. G. W. Holford, general manager of the Salford Corporation Tramways, and W. Clough, general manager of the Bury Corporation Tramways.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

CLERK OF WORKS. September 14th.—Mullingar District Lunatic Asylum. £2 10s. per week.—The Chairman, The Asylum, Mullingar, Ireland.

SURVEYOR. — September 14th. — Hollingbourn Urban District Council. £200 a year.—Mr. H. J. Bracher, clerk, Council Offices, 33 Earl-street, Maidstone.

ASSISTANT INSPECTOR OF NUISANCES.—September 20th.—Corporation of Sunderland.—Mr. H. Craven, town clerk, Town Hall.

SURVEYOR.—September 25th.—Warblington Urban District Council. £160.—Mr. W. L. Cooper, clerk, 14 Queen-street, Emsworth.

STEAM ROLLER DRIVERS (2). — Flintshire County Council. 32s. per week.—Mr. S. Evans, county surveyor, Mold.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WOLVERTON.—September 16th.—For alterations to the bathing place, for the parish council.—Mr. R. Williams, clerk, Church-street, Wolverton.

Engineering: Iron and Steel.

SHEFFIELD.—September 11th.—For the supply of materials and works in connection with the laying of cast-iron water pipe and construction of chambers, for the Electric Supply Committee.—Mr. S. E. Fedden, general manager and engineer, Commercial-street, Sheffield.

DUNDALK.—September 11th.—For supplying and laying about 1,600 yds. of 3-in. cast-iron pipes, and supplying and erecting a fountain and valves, for the rural district council.—Mr. Cahill, Francis-street, Dundalk.

RHONDDA.—September 12th.—For the supply of two scavenging wagons, for the urban district council. —Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

CAPE TOWN.—September 18th.—For the supply of pumps, motors, switch-gear, cables, cast-iron pipes, sluice valves, penstock gates and screens, overhead travelling cranes, and tipping wagons and rails, for the main sewage pumping station.—Messrs. Davis & Soper, 54 St. Mary Axe, London, E.C.

GISBORNE (New Zealand).—October 2nd.—For supplying and erecting a cooling tower for cooling the circulating water used for condensing 9,000 lb. of steam per hour, for the borough council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

ARGENTINE.—October 13th.—For the supply of 27,807 metric tons of light pipes and 32,164 metric tons of heavy pipes of cast-iron, for the Ministry of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Mechanically-Propelled Vehicles.

SEVENOAKS.—September 11th.—For the supply of a steam motor wagon, with a separate tank of 1,000 gallons capacity, fitted for street watering, in addition to ordinary wagon-body, for haulage, for the urban district council.—Mr. S. Towlson, surveyor, Argyle-road, Sevenoaks.

Roads.

CHELMSFORD.—September 11th.—For kerbing public footpaths, and laying paving footpaths, for the corporation.—Mr. Percival T. Harrison, borough engineer, Municipal Offices.

MANCHESTER.—September 12th.—For the supply of pitch for paving purposes, for the Tramways Committee.—Mr. J. M. McElroy, general manager, Corporation Tramways, 55 Piccadilly, Manchester.

CARDIFF.—September 13th.—For road widening at Penhill, for the corporation.—City Engineer, City Hall.

DUNMOW.—September 14th.—For the supply of broken granite, 1½-in. to 2-in. gauge, for the rural district council.—Mr. A. E. Floyd, clerk, Dunmow.

BRITON FERRY.—September 16th.—For the supply of broken granite or basalt road metalling, for the urban district council.—Mr. H. Alex. Clarke, engineer and surveyor, Council Offices, Briton Ferry.

HARROW.—September 16th.—For the supply of broken granite, granite chippings, coarse and fine gravel, tarred granite or slag, and tarred granite chippings, for the urban district council.—The Surveyor, Council Offices, Harrow-on-the-Hill.

SOUTH MIMMS.—September 26th.—For the supply of about 300 tons of Leicestershire or other granite, 1½-in. to 2-in. gauge; 150 tons of ⅜-in. chippings; and 500 tons of blast-furnace slag, for the rural district council.—The Surveyor, Potters Bar.

Sanitary.

BLAYDON.—September 12th.—For the removal of contents of ashpits, for the urban district council.—Mr. R. Biggins, Council Offices, Blaydon-on-Tyne.

FAREHAM.—September 12th.—For house scavenging and emptying cesspools, for the rural district council.—Mr. A. Laker, clerk, 97 West-street, Fareham.

BAKEWELL.—September 16th.—For the construction of a small sewerage scheme, comprising about 110 yds. of 9-in. sewer, with manholes, tanks, and filter-bed, for the rural district council.—Messrs. Brady & Partington, engineers, Town Hall, Chapel-en-le-Frith.

LANCASTER.—September 23rd.—For the removal of house refuse, for the rural district council.—Mr. J. Littlefair, 5 Dulton-square, Lancaster.

HINCKLEY.—September 23rd.—For the removal of nightsoil and house refuse, for the rural district council.—Mr. M. Roberts, inspector, Sapcote.

Stores.

SHEFFIELD.—September 11th.—For the supply of materials and works required by the Electric Supply Committee.—Mr. S. E. Fadden, general manager and engineer, Commercial-street, Sheffield.

HYDE.—September 23rd.—For the supply of engine slack, pitch, oil, cement, and iron castings, for the corporation.—Borough Surveyor, Town Hall.

LEATHERHEAD.—September 26th.—For the supply of broken granite, team labour, disinfectants, brooms, paraffin oil, steam rolling and scarifying, for the urban district council.—Mr. Sidney R. Drake, surveyor, Council Offices, Leatherhead.

HENDON.—September 28th.—For the supply of broken granite, tar-paving material, tarviated granite, granite chippings and gravel, brooms, shovels, forks, and carting materials, for the rural district council. —Mr. J. A. Webb, Great Stanmore, Middlesex.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

HOLLINGBOURN.—For rebuilding part of a bridge and erecting oak fences, for the rural district council:—

Pack & Waghorn, Egerton	£170
W. T. Burrows, Maidstone	110
J. & S. Clark, Lenham	73
W. Collins, Boughton Malherne *	66

ISLE OF THANET.—For the supply of two wrought-iron galvanised hot-water tanks, for the Guardians:—

A. Olby, Limited, King-street, Ramsgate, £63.

KILLARNEY.—For building nineteen labourers' cottages, for the rural district council:

D. Collins & Co., Cork	£5,897
E. O'Sullivan, Killorglin	5,186
J. J. Fleming, Killarney	4,807

WANDSWORTH.—For surface-water drainage works at Wandsworth Cemetery, Magdalen-road, Wandsworth, for the borough council.—Mr. P. Dodd, borough engineer:—

T. Adams, Wood Green	£718
Mowlem & Co., Westminster, S.W.	709
E. B. Yewen, Croydon, S.E.	577
D. R. Patterson, Camden Town, N.W.	500
E. & E. Iles, Wimbledon, S.W.	435
H. Kellett, Vernon-road, W.C.	399
J. A. Ewart, Limited, Old Queen-street, S.W.	370
Willis & Powis, Wembley	350
S. Lane, Wimbledon, S.W.*	298

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

16.—Institution of Municipal and County Engineers: Southern District Meeting at Bristol.

21-22.—Municipal Tramways Association: Annual Meeting, Surveyors' Institution.

23.—Institution of Municipal and County Engineers: East Midland District Meeting at Melton Mowbray.

30.—Institution of Municipal and County Engineers: Eastern Sub-District Meeting (Suffolk, Norfolk, and Cambridge) at Stowmarket.

30.—Institution of Municipal and County Engineers: North-Eastern District Meeting at Wath-on-Dearne.

OCTOBER.

7.—Institution of Municipal and County Engineers: Meeting at Watford.

ROAD MAKING.

REINFORCE CONCRETE ROADS WITH
EXPANDED METAL.

EXMOUTH SEA DEFENCE WORKS. Expanded Steel Concrete Slope and Roadway. Length, 1 mile; total width of Roadway, 65 feet.
Mr. Samuel Hutton, Urban District Council Engineer and Surveyor

THE EXPANDED METAL COMPANY, LIMITED
(Patentees and Manufacturers of Expanded Metal).
Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.
Works: STRANTON WORKS, WEST HARTLEPOOL.

Straker-Squire

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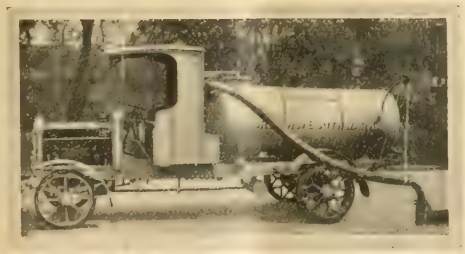
all types of Vehicles



This Petrol Motor Gully Wagon in the service of the Borough of Southwark is effecting a saving of 20 per cent.

5-Ton "Straker-Squire" Wagon supplied to Messrs. Bristowe & Co., of Westminster, S.W., for dealing with tar in barrels.

to suit PUBLIC WORKS requirements.

STRAKER-SQUIRE (1913), LTD.,
56—NELSON SQUARE—56
Blackfriars, LONDON, S.E.

Telephone: Hop 369 & 370.

Telegrams: "Rhomboidal, Friars, London."

APPOINTMENTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Assistant in County Surveyor's Office. Must have good knowledge of modern road and bridge construction, be an active motor cyclist, and ineligible for the Army. Salary £120 and allowance of £30 per annum for upkeep of motor cycle. Apply, giving age and full particulars of experience, to

GORDON R. FOLLAND,
Acting County Surveyor.

13 Chamberlain-street,
Wells. Somerset. (3,066)

HOLLINGBOURN RURAL DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR.

The Council invite applications for the Appointment of a Surveyor of Highways for this District at a salary of £200 a year, the duties to commence on the 1st day of October next.

The appointment to be subject to termination by six months' notice. Applications must be accompanied by three recent testimonials to be received by me not later than 10 o'clock on the 14th day of September next.

By order of the Council,
H. J. BRACHER,
Clerk.

Council Offices,
33 Earl-street,
Maidstone.
August 24, 1916. (3,077)

WANTED—Two or three Working Foremen, used to tar-spraying and the laying of tar-macadam roads, footpaths, playgrounds, &c. Give full particulars, experience and wages required. Must be ineligible for military service.—Apply B., c/o W. H. Smith & Son, Lichfield-street, Wolverhampton. (3,080)

WANTED—Driver for Steam Roller. Apply F. Richards, Surveyor, Oldbury, Bridgnorth. (3,081)

TENDERS WANTED.

ANNUAL CONTRACTS.

LEATHERHEAD URBAN DISTRICT COUNCIL.

The above Council invite Tenders for the undermentioned Materials and Work for the year ending September 30th, 1917:—

Broken Granite.
Team Labour.
Disinfectants.
Brooms.
Paraffin Oil.
Steam Rolling and Scarifying.

Specifications and Forms of Tender can be obtained at the Offices of the undersigned.

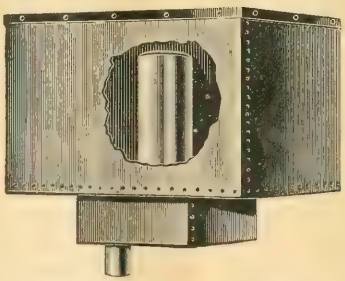
Tenders to be sealed and delivered to me by 5 p.m. on Tuesday, September 26th, endorsed "Tenders for —."

The Council do not bind themselves to accept the lowest or any Tender.

SIDNEY R. DRAKE,
Surveyor.

Council Offices, Leatherhead.
September 2, 1916. (3,079)

BRABY'S
AUTOMATIC FLUSHING TANKS.



SIMPLE. RELIABLE.

Illustrated Price List on application.

FREDK. BRABY & CO. Ltd., 352 to 364 EUSTON RD., N.W. IDA WORKS, DEPTFORD, S.E.

Security £6,349,479

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FIRE.
Consequential Loss.
ACCIDENTS.
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Insurance against BOILER EXPLOSION and ENGINE BREAKDOWN.

Head Offices { 45 DALE STREET, LIVERPOOL. 155 LEADENHALL STREET, E.C.

Willcox's REQUISITES

of every description, including Pumps, Hose, Water Lifters, Jointing for Pipes, Valves, Specialities as illustrated, and Road-roller Stores . . . .

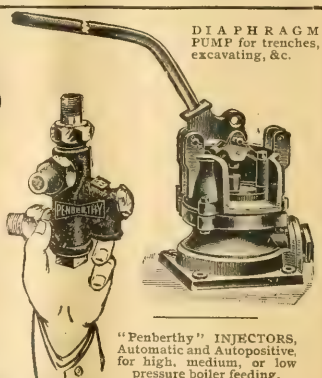
for Borough Engineers and Surveyors.

We can supply YOUR requirements promptly and at reasonable prices. . Write, 'phone, wire or call. A copy of our 736 pp. CATALOGUE will be gladly sent upon receipt of application on business form.

W. H. WILLCOX & Co., Ltd.
32-38 Southwark Street, London, S.E.

"Penberthy" Automatic CELLAR DRAINER for removing "flood" troubles.

DIAPHRAGM PUMP for trenches, excavating, &c.



"Penberthy" INJECTORS, Automatic and Autopositive, for high, medium, or low pressure boiler feeding.

The Surveyor

And Municipal and County Engineer.

Vol. L. SEPTEMBER 15, 1916. No. 1,287.

Minutes of Proceedings.

The Engineer and the Future.

The strength of the engineer in new countries is due to the fact that he is unhampered by tradition, and does not have to consider a number of conflicting interests which bind the engineer in this country. Here too much respect is paid to the past, which, glorious though it may be, is less important than the present and of very little consequence in comparison with the future. Links with the past are regarded by many persons as being sacred, whereas they are very often merely fetters which bind us to old and worthless methods. The habit of thought which looks with suspicion and dislike upon every new method or change is not one which belongs to the engineer, but it does belong to those who employ him. The type of man who is elected to represent the people in Parliament, on municipal councils, or on boards of directors possesses on the average one strong characteristic dear to the heart of the general public in the past—namely, a rooted dislike and mistrust of new methods. Men of this type, who consider all inventors more or less crazy, who will risk no money on "the mad ideas of engineers or scientists," who think that reinforced concrete is not to be trusted sufficiently to merit a long-period loan, who are ever looking backward and never forward—these men have been in the past generally esteemed persons of sound common sense such as should deal with the spending of public money. The result is pitiable. In a time of stress like the present we find that many important trade methods—the property of the enemy—are unworked and unknown in this country. While the engineer in the newer countries is developing new methods and carrying out great works which are of incalculable value and saving, the engineer in this country, in no way inferior in energy or knowledge, must mark time and do just as much as his employers and various Government departments and other authorities will permit.

Will the present war and the conditions which produced it lead to any change? In this time of great need the engineer has suddenly come to the front and saved the situation, working for once unhampered. The result is a sudden marvellous advance in many mechanical matters, such as the flying machine, and in many others which may not be mentioned. The hour found the man ready, and this war will be won by the mechanical engineer. Will such an object-lesson produce any result in the other branches of the profession? Is it too much to hope that a time will arrive when the engineer will be allowed to carry out what he really knows and believes to be the best scheme? At present he cannot do so, for he knows that if he did he would at once be hampered at every turn by persons and authorities who would demand a precedent and stop anything that was beyond their very limited comprehension. Thus the successful engineer must be a diplomatist who can work out a scheme which will first of all avoid all these pitfalls and objections made by corservative persons and authorities, and who can, moreover, ingeniously contrive to produce a scheme that will give certain results required without wasting too much money. That large sums of money are wasted owing to the way in which engineers are thus hampered is well known to any municipal engineer. Certain items of waste he must accept—*e.g.*, it would be absurd under certain conditions to suggest reinforced concrete, notwithstanding the great saving which its adoption would effect. It would be risky to suggest the purification of sewage by dilution in a large river, notwithstanding the advice of the Royal Commission experts. Sterilisation of an abundant water supply near at hand would (notwithstanding hundreds of splendid examples) very likely be rejected in favour of a more costly scheme wherein the always risky expedient of making deep borings was included, or in which a long line of main was carried to a purer source. Sterilisation of sewage would be regarded as an impossibility, notwithstanding excellent existing examples. The laying of new mains to replace those injured by corrosion within a comparatively short period would be readily approved, but a scheme wherein the water was to be treated so as to prevent the corrosion would possibly be difficult to carry through. Endless similar instances could be given showing beyond doubt that the engineer in this country is rarely allowed to use his full knowledge in the practice of his profession, say to the same degree as the medical man can in his profession. Having obtained the services of an engineer, it is customary for his employers to require him to prove the merit of his scheme by reference to other older works. Nothing entirely new and original is likely to be accepted, and if it were accepted it would be upset by some higher authority. Progress under such conditions is almost impossible, and waste of public money is assured.

The immediate future will be a time when brains must be used to the uttermost in order to prevent waste. Those employed for the work must be men of proper attainments, and must be trusted to the degree to which their attainments

enable them. The prejudice against new ideas and methods must be removed, and, with the general acknowledgment of the value of scientific training and knowledge, better times should come. Things move quickly in this age; what was good a short time ago has already been outclassed and superseded. To work by precedents under such conditions is the greatest folly. What is required now is the newest and best. A period of reconstruction is at hand, of great engineering activity, a time of new opportunities in which the engineer must have a free hand if this country is to reap the full advantage. Those who stand in the relation of employer to the engineer must be men of a different type. The over-cautious, scientifically ignorant man, formerly regarded as a person of sound common sense, is already disappearing. He is a back number and a link with the past with which we can readily dispense. Similarly it should shortly be impossible for Government departments to stand in the way of progress; they too will have learned something from the present as distinguished from the past.

* * *

State-aided Research.

Mr. Gerald Stoney, of Newcastle, who presided over the engineering section at the recent meeting of the British Association in that city, drew attention to the handicap which our industries impose upon themselves by their reluctance to utilise highly educated labour or to adopt scientific methods. There can be no doubt that if our future competition with other countries is to be successful, much greater attention must be paid to the vitally important work of scientific research. There are three distinct channels through which such work may be carried on, and we venture to say that in every one of them Great Britain has hitherto been far behind her competitors. First, there is the employment of scientists for research work by individual firms or combinations of firms. In this direction there has not only been the general reluctance to which Mr. Stoney referred, but internecine competition has led to a general failure to appreciate the true value of combined action in any given trade as a weapon against foreign encroachment. In the national interest it may be stated as a general principle that improved methods of production should be made available for all who may be interested. The next medium is that of the engineering colleges. Much good work has been done in this direction, often under great difficulties for want of plant and money, and it is greatly to the credit of our professors and others that they have succeeded in doing so much with the very inadequate appliances at their disposal and handicapped for want of funds. How inadequate their income is can be understood when it is remembered that Leipzig University alone has an annual income from the German Government of £100,000, as against a total Government grant to all the universities here of about £45,000. Finally, there are the National Research Laboratories. Of these there is only one in this country —the National Physical Laboratory at Teddington—and here again the support given to it is totally inadequate. The total income from all sources last year was only £40,000, and of this £23,000 was charges for work done, such as testing meters and other instruments and similar commercial work; the Government grant was only £7,000 a year, and besides this £7,500 was received for experiments in connection with aeronautics, which was really war work. The balance was made up of subscriptions, grants from technical societies, and miscellaneous receipts. Compare this with the German equivalent, the Reichsanstalt of Berlin, which has an income of £70,000 a year from the Government, or ten times that given to our National Physical Laboratory. The Bureau of Standards, the similar institution in the United States of America, has a Government grant of £140,000.

It was an interesting circumstance that Mr. Stoney's address should have been delivered within a few days of the issue of the first annual reports of the Privy Council Committee and the Advisory Council appointed to carry out the scheme initiated last year by the Government for the promotion of scientific research in relation to trade and industry. Summarising the conditions which appear to them necessary for the success of their work, the council point to the necessity for a largely increased supply of competent researchers, and a hearty spirit of co-operation among all concerned—men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities and Government departments. Neither condition will be effective without the other. The first cannot be secured rapidly at any time, and for the moment is out of the question. As regards the second condition of success, progress in co-operative effort is undoubtedly being made in many directions. But there are specially strong reasons for more co-operation between the various British firms in each industry and between the industries and the State in the furtherance of research. In our opinion finance is at the root of the matter, and the serious problem that will arise after the war can only be solved by larger State grants to colleges to be used, in part at any rate, as research studentships, and by largely increased financial aid for research work in each of the other directions above indicated.

* * *

Water Supplies in Scotland.

We have on a former occasion discussed in these columns the desirability of the establishment of a central water authority for England and Wales with a view to securing a more equitable utilisation of the available sources of supply, and we now turn to the almost equally important case of the Scottish water supplies. In Scotland, as in England, the present system by which power to take supplies is obtained in each case by an application to Parliament or by Provisional Order under the Private Legislation Procedure (Scotland) Act, 1899, is apt to work unfairly in more than one way. In the first place open competition for the sources of supply is bound to give an advantage to the larger and wealthier towns. On the other hand, the practice of giving the smaller local authorities on the route of the main pipeline the right to demand a supply from the promoters of a large undertaking not infrequently operates unfairly against the larger authority. The general principle of affording these ancillary supplies *en route* is both fair and economical, but experience has shown that the right to demand them is often obtained when they are not wanted or used, and the considerable expense incurred in installing works so as to be able to meet the demand, if it should be made, is entirely wasted. Another undesirable result of the present mode of proceeding arises in cases—not infrequent—where two adjoining local authorities take separate supplies of water from neighbouring sources when a sufficient supply for both communities could have been obtained from one source at a very considerably reduced expenditure.

In the *Journal of State Medicine*, Mr. John L. Jack, the town clerk of Dunfermline, who has had considerable experience of the defects of the present system of allocating the sources of water supply in Scotland, urges the desirability of reforms in the directions indicated. It will be remembered that in 1910 a Bill was introduced into Parliament having as its main object the provision for further control over the sources of supply in England. The Bill was referred to a

Joint Select Committee and it is interesting to hear in mind that this committee, after full consideration, embodied in their report a definite expression of opinion that any local authority asking for a supply *ex trans tu* should be obliged to enter into a definite obligation to take or pay for the supply so demanded. In the last paragraph of their report the committee urge the need for a survey, at once comprehensive and in detail, of the water supplies and water needs of the country, and for the adoption of measures for conserving the supply and disposing of it to the best advantage. Such a policy is becoming increasingly necessary both for Scotland and England, and it is to be hoped that an early opportunity may be taken of carrying it into effect on the termination of the war.

* * *

The Dublin Town Planning Designs.

In recording the fact that three local men, in the persons of Prof. Abercrombie, Mr. Sydney A. Kelly, and Mr. Arthur J. Kelly, had been awarded the prize in the replanning of Dublin competition, the *Liverpool Post* reminds us that this particular scheme is really the first town planning competition for any capital city in the British Isles, the others having been schemes merely for laying out or relaying portions of a city or district. It is, of course, a fallacy to suppose that the competition had its origin in the recent regrettable events in Dublin. These events had an influence in hastening the decision of the assessors, but the fact remains that the movement emanated from Lord Aberdeen, and followed upon a Royal Commission on the rehousing question in Dublin which sat before the outbreak of the war. The writer of the article states that the dominating idea embodied in the Abercrombie-Kelly plans has been the creation of a new central area and traffic centre on a site now occupied by derelict property. For such a traffic centre there is an urgent need in Dublin, inasmuch as Sackville-street, the leading thoroughfare—large!, a monumental street—fails to provide the necessary space for traffic circulation, especially for tramcar traffic. Right in the heart of this central area it is proposed to build a central terminus for all the railway lines entering Dublin. At present the respective termini are wide apart, and one or two are inconvenient of access. On this central area all the main streets are to converge, and in addition there are to be two or three new outlets to the suburbs, as well as a new and picturesque Mall connecting up Phœnix Park with the city proper. The successful competitors have also dealt with the housing question by a large building scheme to accommodate quay workers on lines already adopted in Liverpool, and have allowed for suburban development in three other places, also providing for a reclamation scheme in Dublin Bay and an extension of the docks. Mr. Sydney A. Kelly, who with his cousin Mr. Arthur J. Kelly and Prof. Abercrombie share the prize-winning honours, are to be congratulated upon their success. The first-mentioned gentleman has already done town planning work. In conjunction with the city engineer of Liverpool, Mr. J. A. Brodie, he laid out Queen's-drive, a well-known avenue on the outskirts of that city, and others of his schemes are said to be distinguished for their technical skill, practical knowledge, and progressive thought. The designs, we may state, will be exhibited for public inspection at a town planning exhibition to be held in Dublin at an early date.

* * *

Responsibilities of Municipalities.

In his report covering the year ended June 30th last, Mr. G. S. Burt Andrews, the town engineer of Johannesburg, has a note with regard to two interesting cases which have been decided by the Supreme Court—the one as to his council's liability in the diversion of storm water, and the other the liability for the maintenance and care of public roads. In the former case the Court held that a municipality is entitled to construct drains and to divert thereby the natural flow of water, and that in so doing it will not be liable if no greater burden be placed on private property either as regards the quantity, velocity or direction of the water which in the ordinary course of nature would flow over such property. The other case is one in which a cyclist collided with some stones on an unmacadamised road, and, in consequence, received injury to the thigh. The Court held that the law imposed no greater liability upon a municipality for failure to keep in repair the ordinary surface of a properly constructed or repaired road than in respect of a road which had never been the subject of municipal operations. These judgments are of the utmost importance to this department, as they clearly define the council's liability on the questions of storm water and roads. The question raised in the former case has not, so far as we remember, been the subject of any decision in the English Courts. The principle that there is no right to the natural flow of underground water which is not in a defined channel is well established; but the Johannesburg case is the reverse of this, and will form a useful precedent to any local authority that may be sued in respect of damage due to an increased flow brought about by drainage works. The case of the injured cyclist, although of local importance, is not of such great interest in this country, where the principles of liability on the part of highway authorities for negligence are fairly clearly defined. It is obvious that no action for negligence founded on non-repair can succeed against a highway authority in respect of a highway for the repair of which they are not responsible; and in the case of highways for which they are responsible, the broad principle that they are liable for acts of *misfeasance*, but not for acts of *non-feasance*, is well established, although often difficult to apply to the facts of individual cases.

* * *

Surveyors and Petrol.

There is still considerable dissatisfaction with the allocation of petrol supplies since the census was taken some weeks ago. We have already called attention to the totally inadequate allowances made to surveyors whose consumption of the precious spirit is wholly or mainly due to the performance of important public duties which necessarily entail much travelling by road, and particulars of another example have reached us. Our correspondent is a district surveyor responsible for 200 miles of district and 80 miles of main roads, maintained by contract, in a very hilly neighbourhood in which labour is scarce in consequence of the war. He made out a petrol return asking for the honest low minimum of 12 gallons per month, and in due course received an intimation that 6 gallons per three months had been allotted. He replied asking whether an error had been made or whether it was that he had been wrongly classified, as his "running" was entirely on district supervision. Ultimately a reply was received to the effect that no more than 6 gallons could be allowed. If, as we fear, this case is typical of many others, the position is certainly astonishing. The total amount of petrol applied for was so far in excess of last year's consumption as to demonstrate the existence of widespread dishonesty in making out the returns. The nett result seems to be that, while pleasure riding in private and public vehicles continues to a large extent, the one class of public officials whose work renders motor locomotion a virtual necessity cannot obtain sufficient to enable them to carry out their duties. Cannot the question be raised again in the House of Commons after the recess?

Eastville Refuse Destructor, Bristol.

For several years past the city of Bristol has been a noteworthy centre of activity in ferro-concrete construction of all kinds. The introduction of the Mouchel-Hennebique system in the city was due to Mr. W. Y. Armstrong, the Great Western Railway New Works engineer, under whose direction an important wharf was built to carry railway traffic in the year 1903. This work was followed in 1904 by Brandon Wharf, constructed for the city council, under Mr. T. H. Yabbicom, M.INST.C.E., then city engineer, and Canon's Marsh transit sheds for the Docks Committee of the corporation, under Mr. W. W. Squire, M.INST.C.E., their engineer.

Among other public works carried out in ferro-concrete during succeeding years may be mentioned granaries, transit sheds and other works at Avonmouth (1907-11) for the Docks Committee, the river Frome covering (1906), foundations for a large electricity transformer station (1907), under Mr. H. Faraday Proctor, M.I.E.E., the city electrical engineer, Fishponds Schools (1910) for the Education Committee, from the architectural designs of Messrs. Rodway and Dening, Chaplin-road sewer (1911), and the Eastville refuse destructor works, forming the subject of the present article. In addition to the foregoing, a large number of important structures have been constructed on the Mouchel-Hennebique system in Bristol and neighbourhood for hospital and water authorities, the Great Western Railway, industrial companies and others.

Fig. 1.—View of Approach Viaduct, Eastville Destructor.

The Eastville refuse destructor station of the Bristol City Council includes a long ferro-concrete approach viaduct, tipping platform, destructor building and chimney, shaft foundations, and clinker plant foundations.

The station is situated on the outskirts of the city, a part view of the approach viaduct being reproduced as Fig. 1.

Fig. 2 is a general plan showing the form of the viaduct, which commences at the bridge indicated on the left-hand, making a right-angled bend of 26 ft. 6 in. radius about the middle of its length and terminating at the tipping platform over the main flue between the destructor building and the chimney stack.

Commencing with two curved wing walls, forming an easy approach from the bridge and road, the ferro-concrete viaduct is 22 ft. 6 in. wide over all, having a roadway 18 ft. wide. It proceeds in a straight line for a length of 90 ft., after which comes the right-angled bend, measuring 45 ft. along the inner side, 95 ft. along the outer side, and 70 ft. on the centre line. The remainder of the viaduct is 120 ft. in length, the last two bays being widened to connect up with the tipping platform, as shown in the small plan at the left-hand of Fig. 2.

Various sections of the viaduct are given in Fig. 3. Referring to the longitudinal sections A-B and C-D, it will be seen that the entire structure is founded on ferro-concrete piles, 12 in. square in cross-section, driven to a depth averaging about 26 ft. below the original level of the ground, those in the first portion, 90 ft. in length, being spaced 22 ft. 6 in. apart centre, those in the curved portion being about 15 ft. apart on the inner side and 23 ft. 9 in. apart on the outer side, and those in the remainder of the length being 22 ft. apart, with the exception of the two end bays, where the piles are spaced at intervals of 18 ft. and 14 ft. respectively.

At a height corresponding with the average ground level, the two lines of piles are connected by horizontal bracings, 8 in. wide by 14 in. deep, and above these the piles are carried up as columns for the support of the decking beams.

The two lines of piles are spaced 17 ft. 6 in. apart, the width of 22 ft. 6 in. being provided by cantilever extensions of the transverse deck beams. These members are 10 in. wide by 24 in. deep, their outer ends carrying the railing bases and the kerbs for the roadway. There are three series of continuous longitudinal beams, 7 in. wide by 17 in. deep, the two outer lines being supported by the pile columns, and the inner line by successive transverse beams. The decking is completed by secondary transverse beams, and a continuous slab, 3½ in. thick, on which is laid a pavement of 9-in. by 4-in. by 3-in. Jarrah wood blocks. These details are further illustrated by the sections E-F, and G-H, and by the enlarged drawings of the road construction.

It will be noticed that the viaduct provides for the raising of the ground level along the entire length, and the formation of an embankment at the approach where the wood paving is laid on a concrete bed over the filling.

Fig. 4 is a plan of the ferro-concrete foundations for the destructor building, main flue and chimney shaft. The work consists essentially of a foundation raft for the uniform distribution of the load over the soil, and the raft receives auxiliary support from a number of ferro-concrete piles, thus ensuring absolute security from any risk of settlement or undue strain on any part of the raft. The positions of the piles and the arrangement of the beams in the raft are shown clearly by the drawing reproduced.

The main portion of the foundation is that under the destructor building, measuring 115 ft. 6 in. long by 76 ft. 8 in. wide. As the loads to be carried include a superload of 2 cwt. per square foot and concentrated loads ranging from 2 tons up to 32 tons, the spacing of the piles is not absolutely uniform, and for the same reason the dimensions, as well as the spacing of the main and secondary beams, are varied somewhat with the object of securing maximum stability and economy.

Between the main foundation and that for the chimney shaft is the raft carrying the main flue, this raft being about 35 ft. by 25 ft. 6 in. wide. The chimney shaft foundation is 19 ft. square, and consists of a slab, 9 in. thick, stiffened by four ribs, and supported on sixteen piles in four rows.

All the piles are driven down to a bed of marl, encountered at an average depth of 28 ft. below foundation level. The sections reproduced as Fig. 5 will give the reader some idea of the unusual conditions to be complied with in the design of the foundations.

Fig. 6 contains a plan and sections of the foundations for the clinker plant-house attached to the destructor station. Measuring 76 ft. long by 8 ft. 6 in. wide, the foundation is somewhat similar in

character to those previously described. In addition to a superload of 2 cwt. per square foot on part of the foundation, concentrated loads up to 33 tons have to be carried by some of the piles and beams.

After completion of the tipping platform, official tests were conducted in the presence of Mr. G. E. Ford, deputy city engineer; Mr. Wilson, district surveyor; Mr. Edmund J. Cullis, ASSOC.M.INST.C.E., district engineer to Messrs. L. G. Mouchel & Partners, Limited; and Mr. H. Hoyle, representing the Yorkshire Hennebique Contracting Company, Limited, of Leeds, who were the contractors for this portion of the work.

Measurements of deflection in a selected main beam were taken by means of three Mouchel pattern instruments. This beam extends from a column to one of the outer walls, and has a clear span of 14 ft. One instrument (No. 1) was placed 3 ft. from the column, another (No. 3) 3 ft. from the wall, and the third (No. 2) beneath the middle of the span.

Under a uniformly distributed load of 2 cwt. per square foot the maximum deflections were $\frac{1}{64}$ in. for instruments Nos. 1 and 3, and $\frac{1}{32}$ in. for instrument No. 2, and on removal of the load the beam returned to its original form, showing an entire absence of permanent deflection.

The specification permitted a maximum deflection of $\frac{1}{16}$ in., equal to very nearly $\frac{1}{600}$ of the span, whereas the actual deflection of $\frac{1}{32}$ in. amounted to only $\frac{1}{3376}$ of the span.

A further test, conducted on one of the secondary beams extending between the main beams and wall, and having a clear span of 12 ft. 6 in., resulted in a maximum deflection of $\frac{1}{64}$ in. at the centre, equal to $\frac{1}{2400}$ of the span, as compared with the deflection of $\frac{1}{4}$ in., equal to $\frac{1}{600}$ of the span, allowed by the specification. In this case also there was an entire absence of permanent deformation.

Two months later the portion of the approach viaduct represented in Fig. 7 was tested in the presence of Mr. G. E. Ford, Mr. Harding, and Mr. F. Wilson, representing the city engineer's department, Mr. W. H. Williams, clerk of works, and Mr. Edmund J. Cullis, representing Messrs. L. G. Mouchel & Partners, Limited.

The test load prescribed was a lorry representing

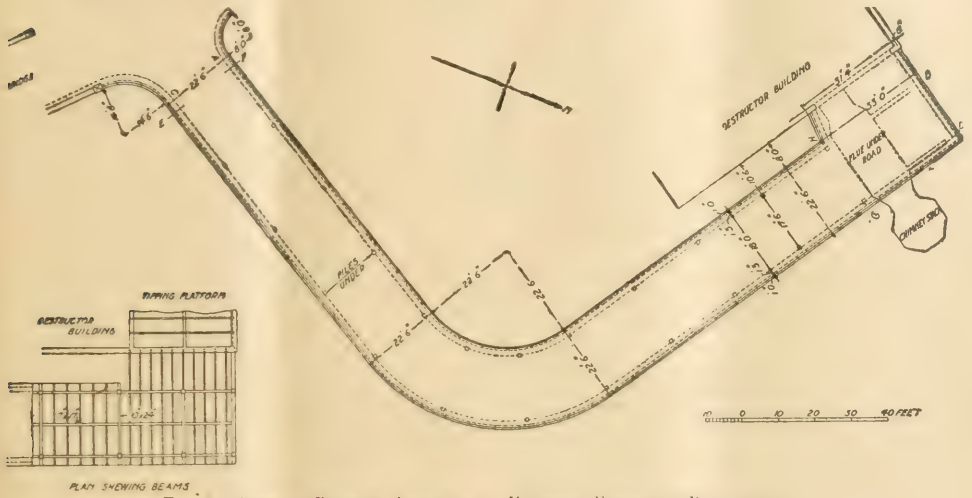


FIG. 2. GENERAL PLAN OF APPROACH VIADUCT, EASTVILLE DESTRUCTOR.

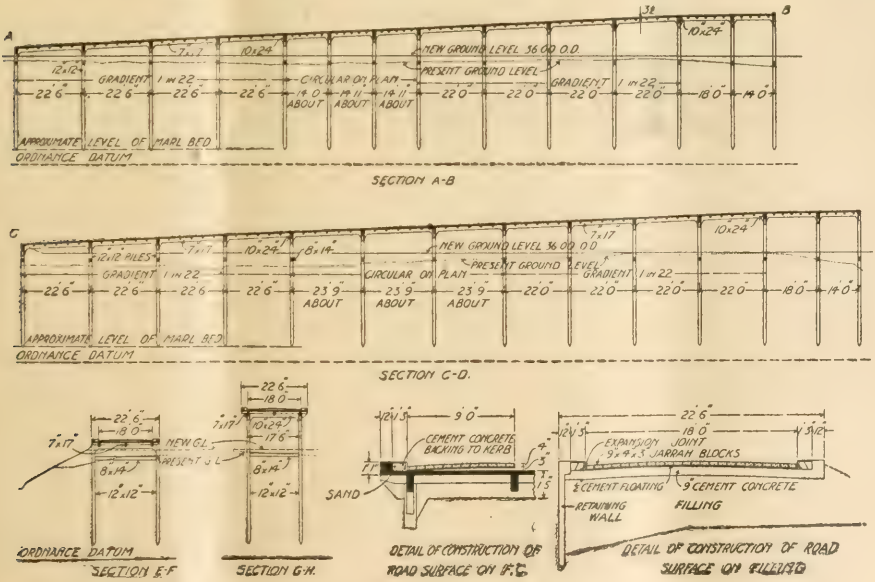


FIG. 3. SECTIONS OF APPROACH VIADUCT, EASTVILLE DESTRUCTOR.

a weight of 8 tons on four wheels. Deflectometers Nos. 1, 2 and 3 were placed under three of the transverse beams, measuring 16 ft. 6 in. clear between the supporting columns.

With the load at a standstill over Instrument No. 2, the maximum deflections recorded were as follows: No. 1 Instrument, $\frac{1}{100}$ in.; No. 2 Instrument, $\frac{3}{64}$ in.; No. 3 Instrument, $\frac{1}{100}$ in.

When the load was moving the maximum deflections at the same points were $\frac{1}{64}$ in. at all three instruments.

The contract conditions provided for a maximum deflection of $\frac{3}{4}$ in., or $\frac{1}{660}$ of the span, which is twenty-one times the deflection actually developed under the test load.

Instrument No. 4 was placed beneath one of the

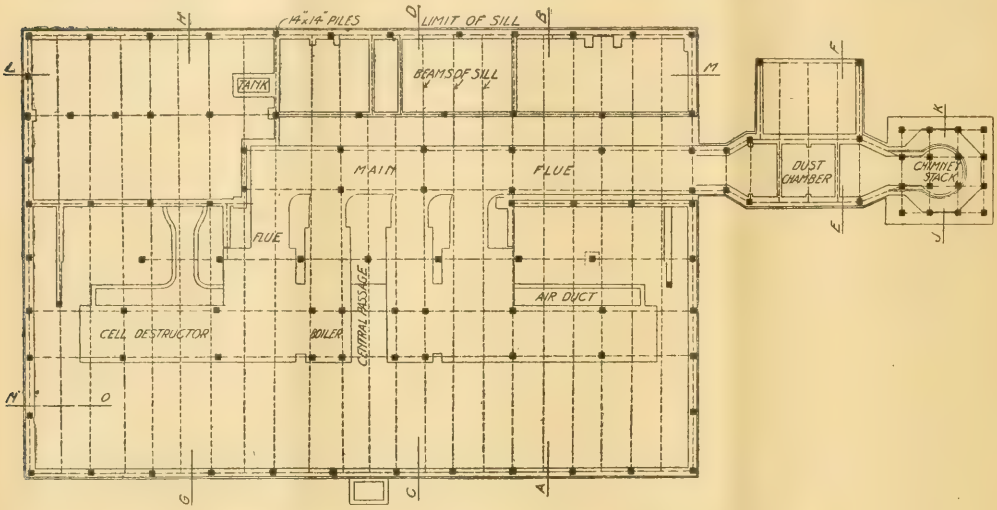
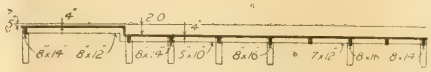


Fig. 4.—Plan of Foundations for Eastville Destructor Building.

secondary longitudinal beams carried by two main transverse beams, the member in question having a clear span of 18 ft. between supports, and when under the moving load of 8 tons it showed a maximum deflection at the middle of $\frac{1}{64}$ in., or $\frac{1}{1080}$ of the span

Section on line A-B.

Section on line C-D.



Section on line G-H.

Section on line L-M.

Section E-F. Section J-K. Section N-O.

Fig. 5. Sections of Foundations for Eastville Destructor Building.

particulars are given of the operating expenses at the Cults steam pumping station.

In the twelve months covered by the report the quantity of water pumped was 585,294,164 gallons, the costs being as follows: Wages, £286; coal, £890; stores,

as compared with $\frac{3}{4}$ in., or $\frac{1}{660}$ of the span permitted by the specification. This result and the absence of permanent deflection sufficiently denote the large surplus of strength and elasticity provided by the construction.

The works were designed by Mr. T. H. Yabbicom, M.Inst.C.E., when city engineer of Bristol, and executed under the direction of Mr. Lessel S. McKenzie, M.Inst.C.E., who has succeeded to the position of city engineer. Working drawings of the ferro-concrete

materials, &c., £53; total, £1,229. This represents a rate of 42s. per 1,000,000 gallons.

Although the cost of coal per ton has very considerably increased during the war, it is satisfactory to note that the actual consumption per 1,000,000 gallons pumped has steadily decreased. The figures for the last six years are 1·67, 1·64, 1·42, 1·41, 1·41 and 1·39 tons.

At the hydraulic pumping station 27,468,315 gallons of water were pumped at a total cost of £80, or £2 18s. 3d. per 1,000,000 gallons.

ABERDEEN CORPORATION WATERWORKS.

PUMPING COSTS.

In the annual report of Mr. C. H. Roberts, the city water engineer of Aberdeen, an abstract of which appeared in our issue of last week, some interesting

WAR AND THE HOUSING PROBLEM.

DISCUSSION AT SCOTTISH SANITARY ASSOCIATION CONGRESS.

On Friday last, at the concluding sitting of the annual congress of the Incorporated Sanitary Association of Scotland, Councillor William Graham, M.A., Edinburgh, in the attern on introduced a discussion on "War and the Economic Aspects of the Housing Problem." It was unnecessary, he said, to do more than mention the admitted evils which everywhere attended bad or deficient housing. Every year tuberculosis reaped its enormous and tragic harvest. Infantile mortality provided painful statistics. In St. Leonard's Ward in Edinburgh the rate in 1915 was 189 per 1,000 births, compared with 45·4 in a well-housed ward like Morningston. With statistics like these in all large centres, a declining birth-rate, and the ravages of war, this was not the age for weak-kneed action in housing reforms. Writers and thinkers of all shades of opinion were now convinced that it was only the great machinery and resources of the State which could effectively face a problem which had largely ceased to be local and was now really national in character. If the money was found by the State any local authority might, under the Housing and Town Planning Act, 1909, as applied to Scotland, borrow money with a period of redemption up to 80 years. The choice which faced us as a people to-day was the plain one of spending public money on good housing, or spending it in the treatment of consumption and other disease, and provision for crime in the crowded areas.

Mr. W. E. Whyte, Middle Ward District Committee, who followed, gave details of the housing scheme carried out by his committee. They had erected 150 cottage dwellings, and were in the course of erecting other 200 cottages. The prevailing conditions were now such that Government should be called on to assist local authorities with a monetary grant until normal conditions returned. The care of public health was committed to local authorities, and if public health was to be preserved housing accommodation must be provided.

Mr. William Ross Young, town planning engineer to the Middle Ward, gave further details of the building scheme referred to.

ECONOMY IN BUILDING.

Mr. Peter Fyfe, Glasgow, said he thought Scottish independence would be against any form of subsidy for housing. Rather wages should be raised to enable working men to pay the necessary rent. Working men's houses in Glasgow were far too substantial, and cost far too much money. In economy in building houses England was far ahead of us.

Councillor Wheatley, Glasgow, said he hoped they would not think Mr. Fyfe represented the feelings of the people of Glasgow on the problem of housing. Since 1914 they had practically doubled wages, but unless they could control not only the wages but the things that the wages had to buy they might as well let things alone. All the things provided in sanatoria—airy bedrooms, beautiful surroundings, nourishing food, and medical supervision—should be provided in the people's homes.

Mr. J. Walker Smith, town planning engineer to the Local Government Board, said the housing conditions in industrial communities in Scotland were worse than in any other part of the United Kingdom, with the possible exception of Dublin. The Englishman paid 12 per cent more rental than the Scotsman, but got 42 per cent better value for his money. The tenement method of housing was an extravagant system.

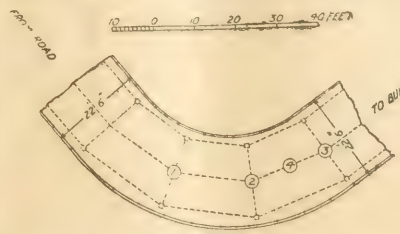


FIG. 7.—DIAGRAM OF TEST AREA IN APPROACH VIADUCT, EASTVILLE DESTRUCTOR.

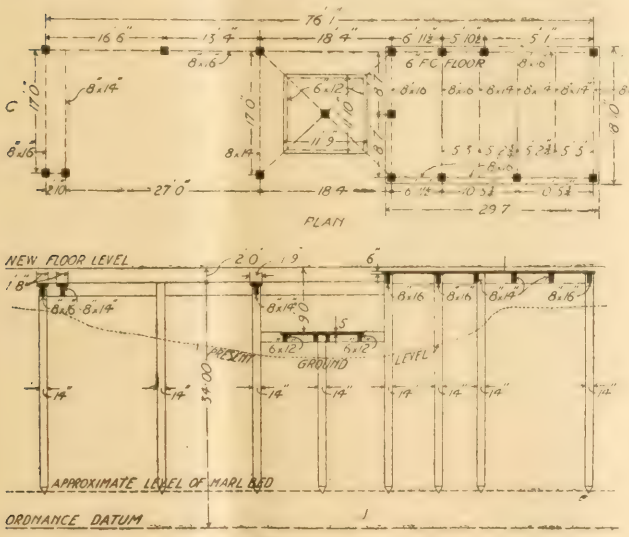


FIG. 6.—PLAN AND SECTION OF CLINKER PLANT HOUSE, EASTVILLE DESTRUCTOR.

Electric Tramway Traction. (By Albert D. Greatorex. Post free, 2s. 8d. St. Bride's Press, Limited, 24 Bride-lane, E.C.).—"Will be of service to those who wish to obtain some general knowledge regarding electric tramway systems."—*Electrical Review.*

Bristol Electricity Profits. The annual report of the Bristol Electrical Committee shows a nett profit of £7,911, out of gross receipts amounting to £132,928. With the balance brought forward and an adjustment of income-tax there is apparently a surplus in hand of £15,721. As a matter of fact £6,429 of that sum has been spent on work not chargeable to loan account, including £2,391 allowances to men serving with the Colours. The £15,721 is thus reduced to £9,292, which is carried forward.

The Future of British Engineering Works.—In view of the national prominence of the engineering industry the Lord Mayor is convening a public meeting at the Mansion House at 3 p.m. on Wednesday, September 20th, to discuss future trade policy with special reference to the economic utilisation of the engineering works of the nation which have been so largely expanded in capacity and equipment during the past two years. The organisation of the meeting is being undertaken by the British Electrical and Allied Manufacturers' Association, with the support of the British Engineers' Association, the British Empire Producers' Organisation, and the Engineering and Electrical Sections of the London Chamber of Commerce. Applications for tickets of admission should be sent to Mr. T. C. Elder, organising secretary for the meeting, B.E.A.M.A. Offices, 36 Kingsway, London, W.C., or to the secretaries of any of the above organisations.

The Use of Motor Vehicles in Municipal Work.

MECHANICAL *v.* HORSE TRACTION.

By H. SHAW, M.INST.C.E., Engineer and Surveyor to the Ilford Urban District Council.

[In the following exhaustive report, prepared for the information of the Works Committee of his council, Mr. Shaw presents a mass of valuable facts and figures derived from the experience of various municipalities, and from his own knowledge, as to the advantages and disadvantages of mechanical versus horse traction, and discusses in detail each method of propulsion in order to enable the committee to decide whether the council's work can be carried out to greater advantage by the substitution of horse labour by mechanical traction.]

Mechanical traction can be employed in a variety of ways, and is being increasingly used by municipalities in street and road works of all kinds, including watering and sweeping, haulage of material, collection of house refuse, gully cleansing, sewer flushing, &c., and no doubt, under suitable conditions, is found to be more economical than horse-driven vehicles, especially during the present time, the existing circumstances involving a shortage of direct labour, difficulties in hiring, and an increased cost in the purchase of horses; and the hiring rates certainly tend towards the adoption of motor traction.

There are many factors, however, which have important relationship to the ultimate success or otherwise of the working of mechanically propelled vehicles, and contribute largely to the suitable conditions.

In the first place, the districts vary considerably with regard to the road surfaces and gradients. In this district the prevailing conditions are advantageous for mechanically propelled vehicles, as the road surfaces are good, and the whole district very level, while the traffic conditions, with the exception of the high road, are favourable, there being little traffic to be contended with, and the vehicles will not always be stopping and starting.

Secondly, with the workshops and engineering appliances under the council's control, the facilities for quick repairs are excellent.

Thirdly, the kind of work or services to be undertaken by traction should be very carefully considered, as, to make any type of traction profitable, it is necessary to avoid very short journeys, provide good loading and discharging facilities, and therefore mechanical tippers should be purchased in every case.

Fourthly, it is also essential that the motors should be kept continually working; in fact, the greater the number of hours a day the machine is actually travelling, the better financial results will be obtained, and therefore interchangeable bodies should be provided, to ensure that each and every chassis should not waste time standing idle.

It is also most important that full loads, up to the maker's guaranteed capacity, should always be carried, as the mileage rate for motor vehicles is greater, generally speaking, than horse labour, and it is only by carrying heavier loads that economy can be achieved; hence the greater load carried the cheaper is the carrying cost per ton-mile.

I should, however, note, *en passant*, that vehicles should not be loaded to more than the maker's guaranteed nett load capacity.

Further, to a large extent the success or otherwise of the motor vehicle depends upon the state of efficiency in which it is maintained. Probably no piece of machinery deteriorates so rapidly as a motor vehicle, if neglected. The hard work required of it, the enormous vibration to which it is subjected, the trying conditions due to dust or mud, and stresses unknown in stationary machinery, all combine to provide the worst of circumstances to which only neglect need be added to ensure early destruction. It is consequently significant that drivers—who are of first importance from this point of view—should be exceedingly capable in their driving capacity and in their knowledge of the intricacies of motor vehicles.

In making my inquiries from municipalities regarding their experiences of mechanical traction, many expressions of appreciation have been given me, such as, "Have given and continue to give every satisfaction," "Tractors very satisfactory in every way," "Has proved to be a great economy and convenience, especially for long journeys and in street watering," "If worked night and day a pronounced success," "By carefully selecting work cartage costs reduced about 40 per cent," "Answers its purpose admirably," "Efficiency the main object, and I think that has been obtained," "Wagon does work of three or four horses," "There is no doubt about the advantage of these vehicles over horses."

It has also been found by private firms and haulage contractors, after many years of experience, that it is far more profitable to work mechanical traction than horse work, and this alone, from a financial standpoint, is conclusive evidence of the superiority of motors in this respect from a contractor's point of view.

In some cases the councils purchase the machines outright, and assume full responsibility for maintenance and running costs, but in a few cases arrangements have been entered into with contractors on a mileage basis.

I believe the Brighton Guardians, for instance, have in the past hired motor vehicles at the rate of 6d. per mile. This rate, however, is being increased to 9d.

The borough of Chelsea have hired from the Leyland Company a vacuum gully emptier.

The vehicles in use differ considerably as to the means by which they derive their motive power, such as steam, petrol, electricity and petrol-electricity. Each of them has its advantage and disadvantage when compared with the others, according to the particular kind of work required to be carried out.

The question of whether steam, petrol, electric or petrol-electric vehicles should be adopted still remains open. The first named has done, and continues to do, excellent work, and the tendency to fit rubber tyres to the wheels is becoming more customary. Petrol vehicles have a large following, and still meet all expectations. As regards electrical machines, the type naturally recommends itself to those responsible for electricity departments, partly because they are specially conversant with its principles, but particularly because, intelligently applied, it can be utilised to equalise the load at the power station, and becomes a profitable consumer. Again, in connection with such work as the removal of refuse, the electric vehicle has strong points. Thus, for instance, in Paris a large fleet of heavy electric lorries is employed for refuse removal, the power required for charging the batteries being obtained from the destruction of the refuse itself, and consequently in a sense is available without charge for fuel.

With reference to petrol-electric vehicles, these are being used to a great extent in connection with omnibus companies, and to some extent by municipalities, and I believe give satisfaction. The electricity is derived from a petrol-driven engine.

In the Royal Automobile Club's trials in 1907 it was shown that excellent results were obtained from petrol vehicles up to 3 tons capacity, but for heavier loads steam had the advantage.

The following are a few of the better-known points in regard to each kind of vehicle, illustrating to some degree the advantages and disadvantages which it is advisable to note.

STEAM.

Substantial and simple in construction, easily worked.

Reserve of power, which is useful on a steep gradient or bad road.

Only in rare cases is it impossible to complete a journey with this kind of machine through breakdown.

Heavier, owing to weight of boiler and storage of coal.

Not available at short notice, as it takes about sixty to seventy-five minutes to get up steam.

While standing there is a wastage of fuel, as steam must be kept up, and the driver, in addition to the machine, is standing idle.

A supply of water is necessary to be at hand, as

it is only possible for this vehicle to run between 15 and 20 miles.

Boilers require to be washed out weekly, and sealed occasionally, thereby losing at least one day's work each week, in addition to about one hour per day (getting up steam).

Two men required to work the vehicle (driver and stoker).

The former must be an engineer.

Annoyance from steam and noise, vibration, projectiles, and consequent complaints.

Oil troubles and quick-wearing bearings from leakage of steam into oiled parts.

Heavy price of coal in this district.

PETROL.

Speedy, and can be turned out at shortest notice.

Quieter running.

Only one man required to drive.

Easier wear on tyres than steam vehicles.

Self-contained.

Not as simple in construction, more easily damaged, and running costs increased by careless driving.

Can be used to best advantages over long distances.

Running costs are increased where continually stopping by wastage of fuel, unless engine is stopped, and strain in starting on working parts.

Slow driving a disadvantage in many ways.

ELECTRIC.

Mechanism simple in character.

Only one man required to drive this type of vehicle.

Quietness in travelling.

Reduced fire risks.

Suitable for short distances, as the constant stopping and starting of the vehicles causes no wastage of power or straining of mechanical parts.

For certain service, where the stopping distances are comparatively short and frequent, electric vehicles are found to be cheaper to operate.

Easy wear on tyres and vehicle.

Use of our electricity.

Speed slower.

In considering this type the least size of battery to obtain efficiency because of weight is an important point.

If battery is run down through oversight, damage might be done to cells, and vehicle might also be left stranded.

PETROL-ELECTRIC.

This is a machine where a petrol engine is engaged to drive a dynamo which provides power to electric motors fitted in connection with the back wheels of the machine.

Can be turned out quickly.

Moderately easy wear on tyres.

Only one man required to drive.

No strain in starting on working parts.

Greater speed than electric vehicles.

Requires a driver with knowledge of this type of vehicle.

Quick in running.

Generally more complicated in construction and design.

In the employment of the whole of these vehicles there seems to be still room for progress in the type of bodies for various classes of services, and also as regards quick loading, although I believe considerable attention is being given to the design of side, end-tipping and interchangeable bodies, and considerable improvements have been and are being made.

I may here mention that there are prospects at the end of the present crisis of further developments in respect to variety and standard of machines to be engaged in municipal work.

It is necessary here to deal briefly with a few of the points previously noted.

In respect to the steam vehicle some of the makers say it is only necessary to have one man for driving, and that an assistant is unnecessary. Also that the boiler need only be washed out once in twelve days, and that it is quite possible to obtain the necessary steam from coke fuel.

These statements are open to considerable argument, and, if assuming the second man is necessary, an outlay has to be made without any equivalent advantage.

It is only possible for a steam vehicle to run from 15 to 20 miles with one fill of water, and it is therefore easy to assume that the driver may misgauge his distance and find himself stranded.

Adverting to the petrol vehicle, the makers inform me that the wastage of fuel during stoppages can be easily lessened by running the engine on a smaller carburetter jet, an improvement they are now effecting in lorry chassis. Also, having regard to the high price of petrol, it is possible for a vaporiser to be fitted, so that the engine can be run on a lower grade, or heavy spirit.

With reference to the electrically driven vehicle, the question of battery is of great importance, and requires to be very carefully considered in conjunction with the item of cost of current and adaptation or provision of plant or cable. Acc. and wastage in voltage. (Electrical firms base their estimate of an "all in" current cost of 1d. per unit.)

I have not deemed it advisable to make any allowances in my figures for the above-mentioned eventualities, and have assumed current price at 1d. per unit.

As to the petrol-electric vehicle this has not yet been very widely used among municipalities, but Tilling-Stevens, Limited, have tendered for such a vehicle, and I believe omnibuses, lorries and mail vans owned by T. Tilling, Limited, are of this make, and are driven with very satisfactory results.

In regard to the running costs of the four vehicles there seems to be very little difference.

The electric vehicles in the first case are exceedingly dear; with the steam, petrol, and petrol-electric vehicles taking second place, the running costs in the three last cases, so far as can be gathered, are slightly more. The electrical vehicle may have an advantage in this matter if the "all in" price of current can be guaranteed not to exceed the price mentioned above delivered in the vehicle at the requisite voltage with a full unit.

Tyres.—Regarding this subject steel tyres are more generally used for heavy steam vehicles travelling up to a speed of about 8 miles per hour, but with a vehicle of lighter tonnage travelling 12 miles per hour and upwards the consensus of opinion is that rubber tyres are a decided advantage. They are much faster, which reduces the running cost, and, by the resiliency of the rubber, effects great saving in the wear of the chassis from vibration, which must mean much longer life to the vehicle. The noise is also eliminated, and the cost, taking all things into consideration, is very little more than steel.

Statements of running costs and comparisons between motors and horses are often misleading unless due consideration is given to local conditions. It is necessary to take into one's calculation the cost of labour, coal, petrol, and horse hire in the particular locality, also the nature of the work to be done and conditions under which it will be carried out. Some drivers will use 50 per cent more coal, oil, &c., than others in doing the same amount of work, and the wear and tear as well as the work done will vary considerably according to the varying capabilities of the men employed.

The method by which the machines are purchased should also be before you, in order that due weight be given to the capital charge.

The figures obtained from other towns must not therefore be taken with any great amount of reliance as being applicable to this district, although they serve to give an idea of what the costs might be should the council adopt mechanical traction.

It is clear from the published statistics that motor vehicles have been adopted to an unexpectedly satisfactory extent by local authorities for miscellaneous services, such as sweeping and watering of streets, the removal of refuse, haulage, &c., and the fact seems now to be clearly established that in services of this sort, in the great majority of districts, motors show a better economy than horse haulage, and this irrespective of the subsidiary advantages of being able to complete a given piece of work in a shorter time, with the consequent power of selecting the most convenient hours for any particular work and frequently duplicating the employment of a motor by providing alternative bodies for it.

I have gathered information from a large number of authorities, which I herewith place before you as follows:

Acton Urban District Council.—There are no motor vehicles on municipal work in the Acton district. The only work carried out to some extent by mechanically propelled vehicles is the collection of house refuse. This work is executed by team labour and a light hauling engine. The refuse is collected from door to door in large vans drawn by horses, and the vans are taken up in pairs to the dust destructor with an Aveling & Porter hauling engine. This has been found to be an economical arrangement, the long-distance hauling being done by motor vehicles, and the short journeys,

with constant stopping and starting, is executed by horses.

Aldershot Urban District Council.—One 5-h.p. steam watering wagon, convertible for haulage.

"Five tons carrying capacity. In the summer a 600-gallon tank is placed upon the chassis for watering purposes. In the winter this is removed and the vehicle employed for the collection of house refuse. The vehicle pays in both respects, while the cost for horses remains at 12s. 6d. per day, but at the old figure during the pre-war period of 7s. 6d. per day the vehicle would not show a satisfactory financial return, and I am not quite sure that it is my council's aim. Efficiency is the main objective, and I think that has been attained."

Anglo-American Oil Company, Limited.—The Yorkshire Commercial Motor Company have supplied this firm with wagons, who say:—

"The wagons have a nett load capacity of 4 and 3½ tons respectively. The all-in running cost is from 20s. to 24s. per day, and the vehicles travel an average of 50 miles per day."

They also state these are the cheapest things the firm have ever had.

Anglo-American Product Company, Limited.—This firm have steam wagons which were supplied by the Yorkshire Commercial Motor Company. Registered tare-weight 4 tons 19 cwts. The wheels are cast-steel with rubber tyres, which have been found more satisfactory both from the maintenance point of view and in running than steel tyres. The front tyres are 850 mm. by 160 mm. Back tyres (twin) 1,050 mm. by 160 mm. The all-in running cost is 1s. 2d. per mile, which is on the high side, but the reason is owing to high wages, also high cost of fuel and oil. They consider the life of the wagon ten years, but for depreciation costs allow eight years.

Barrow-in-Furness.—One 30-35-h.p. (3½ tons) petrol watering wagon and tank.

"Most serviceable. Cost about £750 complete. Solid rubber tyres, preferably single 120 mm. at the front, and twin 120 mm. at the rear. Although not more economical than horses for street watering, this type of vehicle is found to be more convenient, and the convenience is worth the slight extra expense. With regard to running costs everything depends upon method of loading, length of journeys, and whether loads can be run each way. Petrol-driven wagons should not be used for distances under 1 mile. Consumption of fuel also depends on work done, but for a 3-ton 30-h.p. wagon about 35 gallons per week. Life of such a wagon about seven years. Life of tyres approximately some 10,000 miles for rear tyres and perhaps slightly more for front tyres. For the work of general haulage there is no doubt the petrol-driven wagon is cheaper than team labour where distances covered are over 1 mile, but not where frequent starting and stopping and slow loading are necessary."

Bedfordshire County Council.—Petrol motor lorries.

"Haulage of material over long distances 3·93d. per ton-mile."

Birmingham.—Two steam wagons used for moving road stone.

"Capacity about 5½ cub. yds. 5 tons. Cost £580, including 1,000-gallons interchangeable water tank (£90). Make—One by Messrs. Aveling & Porter, one by Messrs. Fodens, Limited. Makers' Standard type; iron tyres. Cost not ascertained, but approximately 9d. per mile."

Blackpool Corporation.—"With regard to the actual saving effected by the vehicle it will be difficult to ascertain until we have the figures for a full season's working; but, although we have only had the vehicle at work since the last week in July, what it has accomplished in this period has convinced me that it will prove a great saving to the department, as the work it can perform during an ordinary day of nine hours is really marvellous. It has already displaced six horse-drawn watering vans, while in connection with the washing of our promenade it has released four men for other work, which is, of course, equal to saving of four wages for this class of work alone.

"Taking an average day of nine hours, the vehicle waters 48 miles of streets, using twenty-four loads, or 18,000 gallons of salt water. The ampère per mile; while the current used in charging, at 5 ampère-hours per unit, is approximately 70 units. The tank has the advantage of being cylindrical in shape, and, having a capacity of 750 gallons, it is capable of watering a good distance before it requires refilling, which takes from five to ten minutes to carry out, according to pressure.

"The usefulness of the vehicle is not limited to the watering of streets, as it has already accomplished good work in connection with the cleansing of sewers, as, with a flush of 750 gallons, we are in many cases saved the trouble and expense of having to resort to dredging operations, which are both slow and costly.

"The vehicle is also used for the washing of streets in conjunction with our motor-sweeping machine, which follows along after the electric vehicle, both machines travelling at the same speed. Only half the usual quantity of water is used, while the work is done better and quicker.

"This street-sprinkler is equipped with a standard 3½-ton 'G.V. Electric' chassis and an 'Ironclad' battery. The battery is charged from the electric plant at the refuse destructor. The tank is made removable, so that, when the sprinkling season is over, a van body may be put in its place and the vehicle used for dust collection or other purposes."

Bradford.—This corporation have a petrol lorry, used for permanent-way work (3-ton capacity), the running cost of which, including petrol, lubrication, tyres, maintenance and depreciation, works out at 7·8d. per mile.

Also a steam lorry, 4 tons 19 cwt. load capacity. No record has been kept of the running cost of this vehicle.

Bristol.—Petrol vans (sweeping machines), used for sweeping wood and pitching; 4-cylinder, 10-12-h.p.; capacity for spraying water, 60 gallons. Cost £638 each (cover for driver extra). Maker—F. W. Archer. Three speeds, one reverse, Ballot engine (French). Solid rubber tyres; wheels, gun-carriage type; petrol per mile, 10 miles per gallon; tyres, £50 per set, guaranteed 10,000 miles. Sweeping machines are easy to handle, and are doing good work.

Two steam vans for general hauling purposes, principally long-distance work. Steam lorries 5 tons 14 cwt. gross weight each; capacity, 10 ft. 6 in. by 6 ft.; 3 tons nett weight each. Cost complete, £545 each. Makers—Yorkshire Commercial Motor Company. 3-ton wagon fitted with mechanically operated tipping gear, 3-speed gear, rubber tyres, and capable of 12 miles per hour; patent Yorkshire boiler, working pressure 175 lb.; solid rubber "Avon" tyres. Fuel, 1s. 8d. cwt.; steam coal per mile, 1 gallon cylinder oil and 1 gallon engine oil per 50 miles. Machine complete, with driver, fuel, &c., charged to works at rate of 25s. per day to cover all expenses and depreciation.

Sweeping machines—Cost per tyre about £11. Maker's guarantee for 10,000 miles.

The lorries and sweeping machines have only been in use for six months, consequently the engineer is unable to give at present any very reliable information regarding maintenance and repairs, which, of course, could be obtained after a more protracted use.

Burton-upon-Trent.—One steam wagon, carrying 4½-ton load.

"Capital cost £614. Used only to convey clinker from refuse destructor to sewage farm 6 miles away; in conjunction with its use a screening and elevating plant has been erected at a cost of £480, and the total annual working expenses, including repairs, amount to £490. Average cost of haulage only is about 6d. per ton-mile, but inclusive of screening, elevating and loading 9d. per ton-mile, including capital charges. We have had this plant now for about ten years, and I have no figures of the cost of doing the same work by horse-vehicles applicable at the present time. Usual cost of haulage by horses is about 1s. per ton-mile."

Chelsea.—Sixteen 40-h.p. steam wagons.

The experience of twenty years has shown that about 40-h.p. is required for an efficient municipal motor van, and a price of £550 is not excessive. Motor vans have been used in Chelsea for municipal purposes since 1900. In all cases the vehicles were purchased out of current revenue, and not by means of a loan. A Leyland vacuum tank has been hired from the makers since 1911 for cleaning out street gullies. Average annual cost of maintenance has diminished from over £60 in 1900 to £40 in 1906.

Average total cost per annum for each motor dropped from £254 (1907-8) to £194 (1913-14).

Cost, less wages of driver, &c., £95 (1907-8) to £77 (1913-14).

Average cost of collection of house refuse by horses and vans for six years, 1901-7, 4s. 9½d. per ton.

Average cost of collection of house refuse by motor vans for four years, 1910-14, 4s. 6d. per ton.

Cost of two motors used for removing house refuse during last three quarters of 1914:—

Motor No. 1. Dust collected average 6 tons 3 cwt. 1 qr. per day.

Cost per motor only, 8s. 9d. per day.

Motor No. 2. Dust collected average 5 tons 8 cwt. per day.

Cost per motor only, 7s. 8d. per day.

Chiswick. Two steam vans used for all purposes.

Eight hundred and fifty gallons capacity water vans: slop vans, 11 cub. yds.; lorries, 11 cub. yds. Cost £655 each, with special vacuum gully emptying apparatus. Maker—Yorkshire Commercial Motor Company. Water vans, iron rectangular tanks; slop vans, sheet-iron well body, 4 ft. 6 in. total height. Lorries, used as lorries with false bottom. Tyres, Avon India Rubber Company, Limited.

It is impossible to give information as to running cost owing to short service, but approximate consumption of fuel is 1 cwt. of coke and 1 cwt. of coal per day on an average of 30 to 35 miles. In addition to body being used for above purposes, it has been provided with a patent vacuum emptying apparatus, a steam jet creating the necessary vacuum, and this has been found fairly satisfactory. Council lets vehicle on hire; resulted in a fair return.

Denbigh. One 5-ton tipping wagon with interchangeable iron tank (1,000 gallon capacity) to fit inside of body, and fitted for street watering and sewer flushing. (Foden—steam.)

"It is used for street watering, sewer flushing, and haulage of macadam and other materials for road repairs. I do not think there would be any saving in the employ of these vehicles for collection of house refuse, &c.—they pay better in long runs than short ones."

Deptford. Petrol-motor sweeping broom.

The cost for one year's working, from February 22, 1915, to February 21, 1916, is as follows:—

Number of days worked, 289. Average mileage per day, 27·78. Average consumption of petrol 3·55 gallons per day, and 7·83 miles per gallon. Lubricating oil, 1 gallon to 175 miles. Axle grease, 1 lb. to 41 miles.

Cost of working the machine for the year stated, including depreciation at the rate of 12½ per cent, is £396 7s. 1d., which is equivalent to 6s. 2·84d. per mile on roadway sweeping.

The cost of the same work had it been performed by horses and horse brooms would have been £665 14s. 3d., or 10s. 5·7d. per mile.

The report specially mentions that during the slight snowfalls in last November the broom was invaluable, and this information is taken from a report which was presented by the borough surveyor to his Works Committee.

Derby.—Steam lorry used for highway work and coal carrying.

Capacity, 10 ft. by 6 ft. by 3 ft.; 8-10 tons, with trailer. Cost, £565. Make, Fodens, Limited. Steel locomotive type; boiler, 70 sq. ft. heating surface. Compound engine. Seasoned-timber body. Driving wheels, 3 ft. 6 in. diameter by 12 in. Front wheels, 2 ft. 9 in. by 6 in. Machine is not in use.

Ealing. Two 25 h.p. (5 tons) steam wagons; trailer, 3 tons.

"For street watering and general haulage (unless gradients are very steep) I consider each lorry supersedes 3 to 3½ horse-drawn vehicles. Should roughly say that, including repairs, depreciation, driver's wages, fuel, &c., the costs amount to about £1 per day."

East Ham.—"I have only one motor vehicle—viz., Mann's combined tractor and roller, which I find most useful for repairing trenches opened by gas company and water board, as I am able with this machine to carry material for repair work and at the same time being provided with the roller for rolling in material. A water-tank can also be interchanged with this machine, but I have not at present had the opportunity of using same, as it is fully occupied on trench work. The cost of the machine was £610.

"The wages paid to the driver is 43s. per week (forty-eight hours). When repairing trenches an additional man goes with him. The running cost for coke, waste, cylinder oil and engine oil is about £1 2s. per week."

(To be concluded.)

A Boiler Experiment. As an experiment the London County Council is altering some of the boilers at Greenwich generating station, so that a cheaper class of coal may be burned. Last year the coal cost £75,000 more than the year before.

CORRESPONDENCE.

Ἓν ἀνὴρ οὐ πάντ' ὁρᾷ

(One man does not see everything.)

—EURIPIDES.

MUD AS A BUILDING MATERIAL.

To the Editor of THE SURVEYOR.

SIR,—I see much interest has been aroused in England in the subject of mud huts, of which the military authorities are said to have built a number. One writer in a recent issue of your journal states that one drawback of a mud wall is the difficulty of rendering the outside surface proof against driving rains and damp atmosphere, as it is difficult to make lime plaster adhere to a mud wall. Apparently, the secret of success in the construction of mud huts lies in the selection of suitable earth. On the West Coast of India, not only huts, but also large dwelling-houses, one and two storeyed, are built of mud, and until recently mud entered largely in the construction of even public buildings.

The method of construction in buildings of greater pretensions than a hut is as follows: The foundations, the corners of the building, the jambs of doors and windows, the sills of windows, and also arches over openings are built of blocks of laterite, which is a ferruginous sandstone. A course of these blocks is also laid at floor levels and at roof level. The rest of the building forming the major portion of the wall area is constructed of mud. The walls are about 18 in. thick, and are run up vertically in layers 2 ft. high between the laterite stone quoins which serve as guides. The walls are then plastered in the usual way with stone or shell lime mortar. The mortar adheres to the mud surface quite as firmly as it does to the laterite surface. There are buildings constructed after this manner which are a century old, and not a few much older. Huts are built entirely of mud, and they are coated both inside and out with a coating of the same earth rubbed down with a wooden float. The surface is then smeared thickly with dung of cattle reduced to a semi-liquid state with the addition of water, and is then rubbed down with a smooth piece of stone. A mud wall so treated stands the heavy south-west monsoon, which lasts three or four months in the year, and precipitates from 100 to 150 in. of rain on this coast. With three coats of limewash on a mud-plastered wall, prepared as described above, it will present as neat an appearance as any wall rendered with a rough coating of lime plaster.

It is believed that the dung hardens the clay surface and renders it impervious to rain and damp. The practice of smearing mud floors and walls with dung of cattle is common throughout India, and even concrete floors are so treated in native houses.

The material used for walling on the West Coast of India, referred to above, is a natural red earth of a very gritty character, with a preponderance of argillaceous matter.—Yours, &c.,

HORMUSJI NOWROJI,
B.E., ASSOC.M.INST.C.E.

Madras.
August 24, 1916.

THE BRITISH DECIMAL SYSTEM.

To the Editor of THE SURVEYOR.

SIR,—We are told that, to save our trade, regain lost ground, and inaugurate the Millennium, we ought to scrap every standard unit we possess in weights, measures and currency, except the pound sterling and the florin, and go in whole-heartedly for decimals in every walk of life, adopting the metric system, and a decimal currency of 1,000 cents to the sovereign. We are told that we possess the most awkward, clumsy, undesirable systems on earth, that we lose time in education, in accounting, in summing, in calculation, and generally that we are in a most hopeless situation of muddle and mess. As is always the case in a crisis, the national attention is being drawn away from the incompetence of legislators. The "system" is to blame, not the "leaders," who never took the trouble to learn that system, and correctly to apply it.

It is not generally known that Gunter's chain is directly derived from the old Belgic yard of 39·6 in., or 5 links, and that the cube of this ancient yard of water at freezing point weighs exactly 2,240 lb., the British ton. We therefore possess already a metre and a metric ton, and we do not need any other. As a matter of fact and history, the French metre is a modern reconstruction of the old Belgic yard and

the *Système Usuel*. The French metre is therefore an approximative modern substitute for a measure which is certainly older than the Great Pyramid—that is, 4,000 years or more.

A metre of 39·6 in. is 1 yard and the tenth of a yard; the metric ton is 2,240 lb.; 50 kilos. make 1 cwt., and 1,000 kilos. a ton; 9 gallons equal 40 litres; and 1 bushel is 36 litres—all British units, of course. Everything which can be said in favour of the metric system is equally applicable to the British decimal system (the B.D.S.). Further, every French constant and formula can be used in the B.D.S. without alteration, correction, or error. A design can be calculated and drawn in the B.D.S. from either British or French data, and its dimensions will be equally correct and in proportion, and quite safe and accurate, whether stated in terms of the metre of 39·6 in. or the metre of 39·37 in.

It is open to every business or professional man to employ the B.D.S. without waiting for an Act of Parliament, and to try for himself what a change over to the metric system really means, while still leaving his line of communication and of retreat to the old position open in case of necessity. The adoption outright of the metric system means burning all British boats and bridges behind.—Yours, &c.,

E. A. W. Phillips, M.Inst.C.E.,
Author of "British Trade and the Metric System."

Rawdon House,
Aymer-road, Hove.
September 13, 1916.

THE BRITISH DE-TINNING SCHEME.

The British De-Tinning Company, of 75 New-street, Birmingham, ask us to state that a clear notice of fourteen days will be sent to the numerous engineers, surveyors, and members of local authorities who have already intimated their decision to be present at the forthcoming conference to be held in London. Should the conference be delayed beyond the end of this month it will merely be with the idea of making possible and convenient the attendance of representatives from Russia, France, Italy, &c., as the company have already had communication from these countries on the subject.

It is also interesting to note that representatives of the Canadian Government who visited this country a few weeks ago, and who interviewed the company, gave the scheme their hearty approval, and have promised to commence operations at once in Canada. In our next issue we hope to publish plans of the new de-tinning works being erected in Southwark borough. The company also propose to put machines in operation at the conference meeting and have them worked by partially disabled soldiers or sailors. The object of the founders of this scheme is to find employment for such men, and once the scheme is operative it would provide employment for several thousands. The British De-Tinning Company's processes are claimed to have special advantages over the German system, inasmuch as the quantity of chemicals used is reduced by 75 per cent; further, those who are interested will be in the happy position of knowing that the work can be carried on successfully on commercial lines, independent of any material and plant from Germany.

The utilisation of waste paper, it may be mentioned, is another matter to which the company are giving attention, and samples of the products from this material will be shown at the forthcoming meeting. We understand that some 4 acres of land have been acquired in connection with this branch of the company's activities.

Scandinavia and Summer Time.—The Copenhagen correspondent of the *Daily Telegraph* states that the experience of Denmark and other Scandinavian countries with respect to the operation of the daylight-saving measure is deemed to be far from satisfactory, as it has not decreased, but largely increased the consumption of electricity and gas, as it is now dark at a time in the morning when the majority of people have to get up, especially the agricultural classes. Many people in the country have reverted to the old time. This also applies to school children, in order that they shall not have to get up in the dark. It is very uncertain now whether Scandinavia will adopt summer time next year.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Must not the water which is supplied to Whitborough, in the parish of Kingskerswell, Devonshire, be of a peculiarly accommodating nature when we read in the *Western Times* that at a meeting of the Newton Abbot Rural District Council a member stated "that the water was good, except on occasions, when it was contaminated, as it was on occasions"? Is not this water supply of the same nature as the little girl who had a little curl right in the middle of her forehead, and when she was good, she was very, very good, but when she was bad, she was horrid?

* * * *

Of surveyors' multifarious duties, are there any limits? What will Mr. Dolamore, the borough engineer of Bournemouth, say to his new appointment as ship's husband to the corporation dredger? Knowing what "husbands" have sometimes to put up with, would not an appropriate song for Mr. Dolamore be "Rocked in the cradle of the deep"?

* * * *

Why did not Mr. Lloyd George consult the St. Asaph Rural District Council before opening a new hut for soldiers at a place called Kinmel? When we read in the *Liverpool Daily Post and Mercury* that the chairman of the council said "he did not consider that even Mr. Lloyd George had the right to open a building before the plans as to drainage have been passed," and that he should be written to at once to ask him by what right he had done so, do we not all tremble for our patriotic and invaluable War Minister when we learn that this council is on his track? Should we not all rally round him and protect him?

* * * *

Where can one easily find statistics of the number of motor cars in the United Kingdom similar to those recently published in our American contemporary *Good Roads*? Is it not interesting to read in a recent issue of that paper that in 1915 there were 2,455,664 motor cars in the United States, and that they contributed nearly 7 per cent—presumably by taxation—"of the money spent on account of building rural roads and bridges?" What is the percentage derived from motor cars in the United Kingdom for similar purposes?

* * * *

Should not Mr. Robert Doughton, of Aberystwyth, feel proud that his name is to be handed down to posterity in the company of such classical heroes as Nero, Agrippa, Pliny, Ptolemy, and others, when we find that the town council of Aberystwyth are about to christen a new swimming bath at Castle Point "Piscina de Robert Doughtonia"? Why is it that some people are fortunate enough to have honours thrust on them?

* * * *

According to a recent issue of the *Contract Record*, of Toronto, that city appears to be between the devil and the deep sea; in other words, it "is still wrestling with the old and vexing question . . . whether it is better to hand over the construction of the various city works to the mercy of villainous contractors, or to run the risks attendant upon the indifferently efficient system generally evidenced in municipal operations." Does this mean that the municipality of Toronto can neither trust contractors nor their own staff, or is it, as darkly hinted by the *Contract Record*, that they can't trust the aldermen and councillors?

* * * *

Is there any deduction to be made from the following figures, given in *The Engineer*, with regard to the number of students who passed through the Engineering Schools of the United States during the year 1915?—Mechanical engineering, 7,751; civil engineering, 7,182; electrical engineering, 6,637; general engineering, 6,059; chemical engineering, 2,387. Does this show that mechanical engineering is more popular as a profession than civil engineering, and had the large number of students in chemical engineering—which it is stated was far above the average—anything to do with the boom in chemical engineering which is sure to take place in connection with scientific road construction in the future?

* * * *

Is it not rather interesting to read that no fewer than 2,000 reinforced-concrete bridges have been built in this country during the past twenty years? What have the Local Government Board to say to

The Surveyor
And Municipal and County Engineer

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this, and will they now extend the period for the repayment of loans for this description of work?

* * * *

What is going to be the effect on locomotion if the price of petrol rises much higher and the supply is further restricted by the Government? Will the withdrawal of omnibuses and taxicabs from our streets cause the reappearance of the ordinary "push-bike," and shall we not all be obliged to employ "Shanks's mare" more than we have done lately? How is this war going to affect peoples habits, if it lasts for another two or three years?

SURVEYORS' PETROL ALLOWANCES.

CONTROL COMMITTEE STATEMENT.

We are officially informed that the question of the allowances of petrol to assistant county surveyors is at present engaging the attention of the Petrol Control Committee. It is not possible, however, at the present moment to grant any increase to those who use cars, except on the recommendation of the Road Board, but in certain special cases the committee are prepared to reconsider the allotment to those surveyors who use motor cycles.

Mussel Purification Tanks at Conway.—For some years the sale of Conway mussels has been prohibited, owing to the risk of their being polluted by sewage. A grant of money by the Board of Agriculture and Fisheries has enabled the Conway Corporation to erect a purification works on the land abutting upon the foreshore, just above the tubular railway bridge. Here the mussels taken by the local fishermen from the bed of the river are to be brought, placed for forty-eight hours in sterilised sea water, and so freed from all contamination. Thence the mussels, with a certificate of purity, will be sent to the various markets. The borough engineer, Mr. F. A. Delamotte, from whose designs and under whose supervision the purification tanks have been constructed, reported at the meeting of the council, on Tuesday, the *Liverpool Post* states, that the process of purification had been proved practical and efficient, and that four tons of treated mussels were placed upon the English market on the 2nd inst. With the exception of one or two very minor alterations, the plant was quite satisfactory. Mr. Delamotte added that he hoped that 80 to 100 sacks of mussels would be dealt with three times a week. In their experiments the investigators had succeeded in sterilising mussels in three hours, but it could not be done so quickly with the mussels in bulk, though the process might be accelerated with experience of the working.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Blackburn T.C. (August 30th. Mr. A. G. Drury).—£71,568 for extensions and improvements at the Greenbank gasworks. The town clerk, Mr. Lewis Beard, stated that in 1913 a serious stoppage occurred, and one result was that the corporation became convinced of the necessity for the complete reorganisation of the gasworks. There were two gasworks—Addison-street, in the centre of the town, where there were no railway facilities, and at Greenbank, where there were excellent railway facilities. At Addison-street there were horizontal retorts and a water gas plant, and at Greenbank there were inclined retorts, which had not proved a success. The new scheme was for the construction of vertical retorts at Greenbank of a capacity of 3,000,000 cub. ft., with the necessary subsidiary plant, and supplemented by a tar-distilling plant to produce materials for the Ministry of Munitions and raw material for the manufacture of dyes. In ordinary times this scheme would be one that would be welcomed, and would be sanctioned as a prudent, well-thought-out, efficient, and economical scheme. Of course, now they had to consider the very special circumstances of the time, and in everything they had to look to the war first and last. The reconstruction scheme, if sanctioned, would liberate sixty men, some of military age, and the others could be usefully employed on munitions. Important economy would be effected in the matter of fuel, and among other things they would produce for sale 38,000 tons of coke, instead of 28,000 tons, as at present. The demand for coke was enormous. If the scheme was not sanctioned, the alternative would be a temporary arrangement which would cost thousands of pounds, and would only be of a makeshift character. As it was, they would have to scrape through this winter as best they could. Mr. A. Morton Fyffe, gas engineer, author of the scheme, said the scheme, which was absolutely necessary, would, it was estimated, effect a saving of £10,000 to £12,000 annually.

APPLICATIONS FOR LOANS.

Ayrshire C.C.—£460 for improving the Kirkoswald water supply.

Batley T.C.—£25,000 for new carbonising plant at the gasworks.

Nelson T.C.—£3,800 for a benzol plant and rotary washer scrubber at the gasworks.

Sheffield T.C.—£1,000 for the completion of the King Edward VII. Hospital.

Westhoughton U.D.C.—£8,757 for a housing scheme.

LOAN SANCTIONED.

Horsham R.D.C.—£2,500 for the purchase of the Billinghurst water supply.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
19.—**Hindley.** For the provision of a humus tank at the sewage works (Mr. P. M. Crosthwaite)	760
20. **Droylsden.** For the provision of a humus tank at the sewage disposal works (Mr. P. M. Crosthwaite)	1,751

Chair of Engineering for Aberdeen.—By the death of Mrs. William Jackson, widow of Mr. William Jackson, Thorngrove, Aberdeen, which occurred on the 1st inst., a large sum will become available for the establishment of a Chair of Engineering at Aberdeen University.

Profits from Waste Paper at Preston.—The Preston Waste Paper Committee have divided £300 among local war charities. The accounts for August showed a cash balance of £109, and of this £80 was voted to the Naval and Military Pensions Fund, making a total to this fund of £230.

"Surveyor" Readers' Gifts to a Labour Battalion.—Subscribers to the fund which was recently opened in these columns with the object of providing the men in one of the labour battalions at the front with an accordion and some sets of quoits will be glad to know that these articles duly reached their destination, and, Captain Cadic informs us, are very greatly appreciated by the recipients.

The Extent to which Sewage can be Purified by Practicable Methods of Artificial Treatment now in Use.*

By HARRISON P. EDDY, Boston, Mass.

(Conclusion.)

The oxidising power of all bacterial agencies depends upon an ample supply of atmospheric oxygen. This must be absorbed by the bacterial jelly of the contact-bed, mainly during the rest period, which is limited to a fraction of the operating cycle, rarely exceeding three-quarters of it. The quantitative efficiency of the contact-bed is low also, because of its limited capacity for the storage of sewage in contact with the bacterial surfaces. These limitations have led to efforts to devise beds which would accomplish similar work without being subject to such restrictions. The most important derivative of the contact-bed is the trickling filter.

Like the contact-bed, this filter is composed of coarse-grained particles, the most popular size at present perhaps being 1½ in. in longest dimension. The thickness of the beds varies from 5 to 10 ft., and their shape depends upon the method of distribution or local conditions of controlling importance. The stone is placed upon concrete or vitrified-tile draining floors. The sewage is distributed as uniformly as may be over the surface of the bed, by revolving arm sprinklers, distributors moving backward and forwards, spreading the sewage as they go, or fixed pressure nozzles which spray the sewage, distributing it in a manner similar to that of the ordinary lawn fountain. Where the fixed pressure nozzle is used it is generally operated under a head diminishing throughout the discharge period from a maximum of about 7 ft. to the minimum, which varies from 1 to 2 ft. The dosing cycle may consist of a five minutes' dosing period and a ten minutes' rest period.

This fluctuation in head may be obtained by a butterfly, or undulating valve, rotated in the supply main, or by dosing tanks so designed as to provide the proper quantity of sewage at each head.

When sewage is first applied to a new trickling filter the suspended matter clings to the surface of the stones, where it is temporarily retained, forming a suitable habitat for the bacteria present in the sewage. Thus a bacterial film, sometimes called bacterial jelly, is gradually built up, covering the surface of the stone of the entire bed. As the sewage trickles over this jelly-like substance, the finely-divided colloidal and some of the dissolved matter is retained upon and in it, and apparently furnishes the food supply for the myriads of micro-organisms present. In this manner the sewage is deprived of its putrescible organic matter, which is gradually worked over by the organisms and ultimately given off to the passing sewage and carried away in the form of mineral or stable organic substances. It is of vital importance to provide the proper quantity of food supply, and an ample opportunity for the absorption of atmospheric oxygen. The operation of the filter is approximately continuous, and thus has a distinct advantage over the contact bed, which of necessity is both dosed and aërated periodically. A typical section of a trickling filter is shown in Fig. 4.

A very highly efficient trickling filter will carry the process of oxidation so far that the effluent will keep indefinitely, and if the contact material is relatively fine, the suspended matter of the sewage and the colloidal matters withdrawn therefrom will be retained and a practically clear and sparkling effluent will be produced. Such a filter will cause a large reduction in the number of bacteria present in the original sewage. Trickling filters are ordinarily built of coarse stone, however, and contain interstices so large that the suspended matter which accumulates temporarily passes away after having been more or less completely worked over by the organisms. Such effluents are turbid and contain settling solids which are commonly removed in secondary sedimentation tanks. In fact, one of the primary objects in the design of trickling filters is to so construct them that the solids shall not accumulate indefinitely in the stone, but may wash out from time to time, and thus avoid the necessity of taking out the stone to free it from the accumulation of such substances which otherwise might ultimately clog the filter. It is necessary, therefore, under ordinary conditions, to accept turbidity and much suspended matter as characteristics of the effluent from this type of filter, and to provide for the removal of the settling solids before its discharge into the diluting waters.

The underdrainage system of the trickling filter is of great importance, since it is necessary to convey the effluent away freely, and also to provide ample means for washing out humus when the bed discharges its accumulation. Many types of filter floor have been used for this purpose. The one used at Fitchburg, Mass., consists of a series of channels cast in the concrete floor, spanned with concrete beams or "bricks," the whole being covered with cobble stones before the filtering material was placed.

The walls of such a filter, if below the ground level, need be hardly more than diaphragms to prevent the material of the filters from mingling with the adjoining earth, and to keep the sewage or effluent from escaping into the soil. Such a diaphragm wall, built by plastering reinforcing steel with mortar by means of the cement gun, was employed at Fitchburg, and is shown in Fig. 5.*

SAND FILTERS.

The intermittent sand filter is one of the oldest devices for the artificial treatment of sewage. It consists of a bed of sand from 3 ft. to 5 ft. in depth, enclosed within embankments, and usually provided with underdrains. It is necessary to use a free draining sand if filters are to be capable of handling a reasonable quantity of sewage.

As the name implies, these beds are operated intermittently. They are dosed by completely flooding the surface as quickly as possible, preventing excessive quantities of sewage from penetrating portions of the bed near the distributors, and thus aiding in uniform distribution. Dosing is best accomplished in the smaller plants by storing the sewage until the desired quantity has accumulated, when the dose is suddenly and quickly released by automatic apparatus.

The sewage percolates through the sand, where it comes in intimate contact with living organisms, as in the contact and trickling filters. In fact, the biological processes appear to be practically identical in these types of filters, although the oxidation is usually carried somewhat further in the sand beds. There is, however, one distinct difference between the sand filter and the trickling filter as ordinarily constructed and operated. The former, due to its fine particles and small interstices, retains the suspended solids mechanically, and is thus enabled to produce an effluent which is clear, sparkling and colourless. The trickling filter, as already explained, because of its large interstices, allows the suspended matter ultimately to pass through it, giving to the effluent a decidedly turbid appearance. A well-operated sand filter will carry the oxidation of the organic matter nearly to completion, converting it very largely into mineral substances. The bacterial reduction may also be far superior to that obtained by ordinary types of contact and trickling beds. Effluents, in fact, are obtained in which the bacteria are less than 1 per cent of the number present in the original sewage, a result fully equal to that obtained by ordinary disinfection.

Obviously the retention of the suspended matter upon and in the sand causes a reduction in its capacity, and if this accumulation is permitted to increase indefinitely, the filter will become practically impervious to water. It is necessary, therefore, to provide for the periodic cleaning of the filters, which is accomplished by raking and scraping off the mat remaining upon the surface of the sand after the filter has become dry. Heavy mats necessitate frequent and expensive cleaning, which may be reduced, to some extent, by passing the sewage through sedimentation tanks before it is applied to the filters. It is usual, therefore, in such installations to combine

* Paper read before the Engineers' Society of Western Pennsylvania.

* Courtesy of *Engineering News*.

with the sand filter suitable sedimentation tanks for the removal of the coarser suspended matter.

The efficiency of sand filters, as well as of contact beds and trickling filters, is much lower during cold weather than in the summer. It is necessary to make ample provision for winter conditions, to avoid the freezing of the applied sewage in a solid layer adhering to the surface of the beds. This is accomplished by turrowing or by raking the surface material into piles, so that the ice-sheet may be held above the normal surface, thus providing a natural roof or cover, below which the sewage flows to the various parts of the bed, and which protects the sand from extreme cold and snow.

BROAD IRRIGATION.

It is hardly necessary to discuss here the merits and demerits of broad irrigation, the oldest method of artificial oxidation of sewage upon land. This method has found little favour in this country.

It is capable, under favourable conditions, of producing a very highly purified effluent, fully equal to that of the sand filter.

DISINFECTION.

The methods of sewage treatment thus far described deal primarily with the prevention of objectionable deposits and offensive conditions. Disinfection deals with the destruction of organisms. Normal municipal sewage may be said to contain about 1,000,000 bacteria per cubic centimetre, while they frequently run as high as 10,000,000 or 20,000,000 per cubic centimetre in old and strong sewages. Of these the great majority are probably harmless. Pathogenic organisms, however, may be present in sewage, and the object of disinfection is to kill such organisms, or to so reduce their numbers that they may not be a menace to health.

For this purpose calcium hypochlorite, or bleaching powder, and liquid chlorine, have been used. The quantity required varies according to the quality of the sewage or effluent to be disinfected and the extent to which it is desired to reduce the number of bacteria. The quantity of available chlorine used varies from 3 to 6 parts per 1,000,000, which is equivalent to 25 to 50 lb. per 1,000,000 gallons of sewage. These quantities of chlorine are equivalent, roughly, to 75 to 150 lb. of bleaching powder per 1,000,000 gallons of sewage.

This treatment is not likely to produce a sterile effluent, but will reduce the number of bacteria growing at body temperature—37 deg. Cent.—from 75 to 90 per cent, and the coli from 90 to 95 per cent. Such disinfection has been assumed to be sufficient when the effluent was discharged into tide water above oyster beds, and an adequate protection of the public where the discharge was into large streams or bodies of water from which water supplies were taken, provided they were efficiently filtered and disinfected before use.

ACTIVATED SLUDGE TREATMENT.

During the past two years the attention of sanitary engineers has been focussed upon a new method of sewage treatment known as the activated sludge process. This process appears to have been discovered accidentally by Messrs. Ardern and Lockett, who presented the results of their original experiments at Manchester, England, in the *Journal of the Society of Chemical Industry* May 30, 1914. They found that when sewage was kept for several hours in intimate contact with sewage sludge, by agitation with a current of air, the sludge assumed the form of a light flocculent precipitate, the suspended and colloidal substances were attracted to and absorbed by these flocculi, and the dissolved matters were oxidised, the free ammonia being transformed into nitrates.

Milwaukee Experiments. Many experiments with this method of treatment have been made, the most notable perhaps being those of the Milwaukee Sewerage Commission, of which Mr. T. Chalkley Hatton is chief engineer, and Mr. William R. Copeland is chief chemist.

This process is still in an experimental stage, although at Milwaukee it was thought that sufficient progress had been made to warrant the construction of a 2,000,000-gallon plant, which was completed in December, and has been in operation two months. The plant consists of eight round aërating tanks 30 ft. in diameter, and of sufficient depth to accommodate about 10 ft. of sewage, including 20 per cent of sludge. Partitions are so arranged as to confine the sewage to channels 6 ft. wide, through which it flows continuously, passing from tank to tank. From the aëration tanks it flows to a sedimentation tank, being admitted at a considerable depth below the surface, and flowing upward to skimming troughs, into which it flows in a thin film at the surface of the tank. Two tanks of similar size are provided for the storage and re-aëration of the sludge collected in the sedimentation tank. The plant is also provided with the necessary air blowers and measuring devices. The equipment for handling, dewatering and drying the sludge has not yet been fully determined upon.

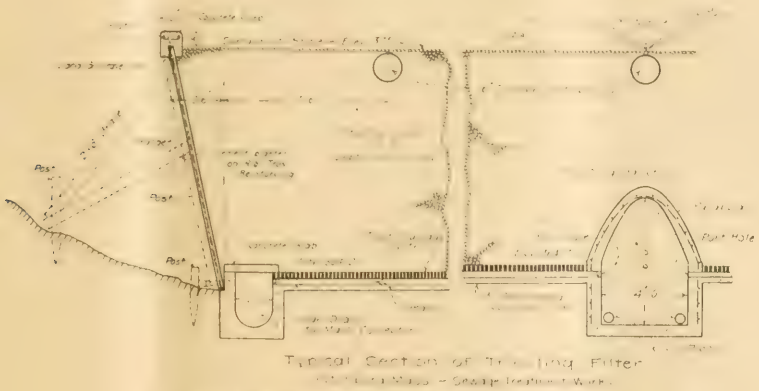

FIG. 4.—TYPICAL SECTION OF TRICKLING FILTER.

Method of Operation. While the methods of treatment in different places vary considerably, the consensus of opinion at the present time (1916) appears to be that operation by continuous flow through the aëration and sedimentation tanks is preferable to the fill-and-draw method which has been used in some of the smaller experiments. The process can be explained conveniently by describing the method of operation of the new Milwaukee plant, as it is intended to be used when certain modifications have been made.

Sewage Aëration.—Sewage flows continuously through the aërating tanks, which are provided at the bottom with an air distribution system, consisting of ducts above which are placed thin porous plates made by the General Filtration Company. These "Filtros" plates are confined to a single row extending along the middle of the sewage channel. The air is admitted to the porous plates under a pressure slightly greater than that exerted by the overlying column of sewage. In this manner the sewage is constantly mixed with the sludge by the rising air, and at the same time the sludge and the liquid are afforded an opportunity to absorb oxygen from the air. Just before the sewage is admitted to the first aëration tank it receives a dose of activated sludge, equivalent to 20 per cent of its volume. The method of preparing this sludge will be described later.

The period of aëration is intended to be about four hours, which obviously corresponds to the length of time required for the sewage to flow through the eight aëration tanks. The quantity of air required for aëration of the sewage appears to be about 1·75 cub. ft. of free air per gallon of sewage treated.

Sedimentation.—As it is important to maintain the sludge in intimate contact with all portions of the sewage in the aërating tanks, it is necessary to provide for sedimentation immediately after the sewage leaves them. The flocculent precipitate, however, settles quickly, and a clear effluent can be obtained from suitable sedimentation tanks. It is expected at

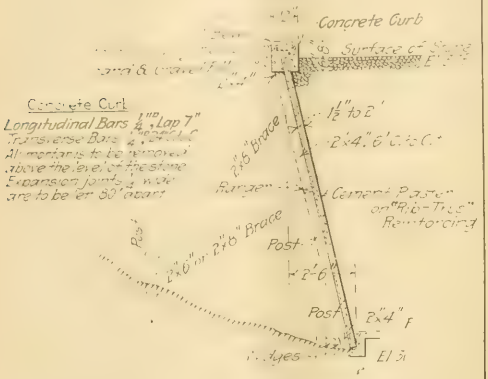

Fig. 5.—Details of Wall for Trickling Filters.

Milwaukee to reduce the quantity of suspended matter in the sewage to less than 20 parts per 1,000,000, as the effluent leaves the sedimentation tank. The suspended matter gradually falls to the bottom, where it accumulates as a thin sludge.

Sludge Handling.—From the sedimentation tank, in which the sludge naturally contains 98 or 99 per cent water, the sludge flows to a deep concentration well, where it is hoped to reduce the water content to 96 per cent or less. From this well the sludge may be pumped into the incoming sewage, or, when necessary, to the sludge reservoirs, where it is continuously aërated to reactivate it before pumping it to the raw sewage.

There are as yet very few data to indicate the quantity of sludge likely to be produced by the activated sludge treatment of sewages in general. The Milwaukee experiments indicate that the quantity will range from 3,000 to 6,000 gallons per 1,000,000 gallons of sewage treated. This sewage is relatively strong, its volume being equivalent recently to about 80 gallons per capita per day. It contains considerable industrial wastes, and may produce an abnormal quantity of sludge.

Analyses of this sludge indicate that when dry it contains sufficient fertilising ingredients to make its utilisation commercially attractive. There are, however, serious difficulties to be overcome in dewatering and drying the sludge. Very little progress has been made upon this phase of the problem.

Theory of Action.—The most noticeable effect of this treatment upon the sewage is the formation of the precipitate called "activated sludge." It is light brown in colour, apparently very light in weight, and readily forms loose aggregations, called "flocculi," resembling precipitated hydrate of iron. These flocculi are found to contain vast numbers of bacteria, which appear to be absolutely essential to the success of the process. It is conceivable that they exude certain substances which give to these flocculi their peculiar absorptive and attractive functions, and which enable them, while passing through the sewage, to gather to themselves the colloidal matter and bacteria, and to absorb certain of the dissolved substances.

The action of this sludge appears to be very similar to that of the bacterial jelly surrounding the stones of the trickling filter. The chemical changes which go on in the sewage, in both processes, appear to be practically identical. The efficiency, however, of the activated sludge flocculi, in holding the colloidal matter, appears to be greater than that of the bacterial jelly of the trickling filter, for the effluent from the aëration tanks, after proper sedimentation, is very clear and sparkling, while the effluent from ordinary trickling filters, even when in relatively good condition, is almost always turbid, even after the settling solids have been removed from it by sedimentation. The two processes, although very similar in theory of action, are carried on under different physical conditions. In the case of the trickling filter, the sewage is the moving medium, passing slowly over the absorbing jelly, by which its finely divided particles and some of the dissolved matter are absorbed, and subjected to bacterial decomposition and oxidation. In the aërating tanks, on the other hand, the bacterial jelly is the moving medium, which, in contact with the sewage, attracts and absorbs the finely divided and some of the dissolved substances, and within its confines subjects them to bacterial decomposition and oxidation.

Character of Resulting Effluent.—The well-settled effluent from the aërating tanks, as observed by the writer at Milwaukee, is clear, sparkling and colourless. It contains ordinarily less than 10 per cent

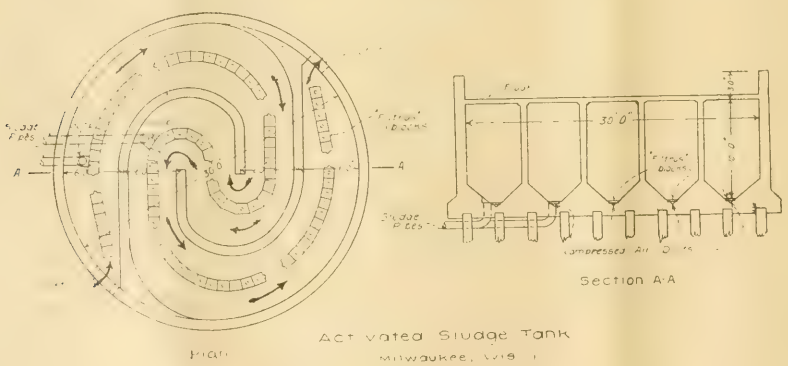

Fig. 6. Activated Sludge Tank.

as many bacteria as were present in the original sewage; it is relatively stable, keeping under exacting laboratory conditions for from three to five days, even in the winter when there is practically no nitrification, due apparently to low temperature of the sewage. In warmer weather there should be no difficulty in producing a stable effluent, and even a highly nitrified effluent.

Application to Trade Wastes.—This method appears to be adapted to the treatment of certain trade wastes. Experiments being made by the writer upon tannery wastes, give promising results, while those upon paper mill wastes are not encouraging, probably because these wastes are not as susceptible to vigorous bacterial action.

Cost.—It is too early to base estimate of cost of this process upon actual operating data. The expense will apparently be divided into two parts, that of the purification process and that of sludge disposal. Air alone, at the rate of 1½ cub. ft. of free air per gallon of sewage treated, will cost about $14 per 1,000,000 gallons of sewage, if power costs 2c. per k.w.-hour. Few small cities can hope to purchase power at a much lower cost, and other methods of treatment are likely to prove more economical unless a profit can be realised from the sludge.

Analyses of activated sludge from different experimental plants vary widely. Some indicate the possibility of a return from sale of commercially dry sludge, sufficient to warrant the payment of a substantial sum for dewatering and drying, but what these processes will cost is now problematical.

COMPARISON OF RESULTS OF METHODS OF SEWAGE TREATMENT.

Sedimentation, with or without screening, is capable of removing much of the suspended matter capable of settling in a short time. Referring again to the hypothetical sewage, by way of illustration, it may be assumed that this process will effect a removal of about 130 parts per 1,000,000 of suspended solids. This leaves 170 parts of suspended solids and 500 parts of dissolved solids, a highly putrescible effluent which is decidedly dirty in appearance. Such an effluent, however, may be turned into some streams and bodies of water without fear of causing serious deposits, and the quantities of diluting water may be such as to fully warrant such a course.

If, however, a better effluent be required, resort may be had to chemical precipitation, by which it is possible to remove colloidal and suspended matters more completely than by sedimentation, and to the extent of perhaps 290 parts per 1,000,000, leaving 510 parts of suspended colloidal and crystalloidal matter in the effluent of the hypothetical sewage. A large part of this consists of soluble matter. Even this reduction is not sufficient to render the effluent non-putrescible, and it might be added that in most cases where this method has been employed the operating costs have been so curtailed that the results obtained have hardly been comparable with those of which the process is capable.

The quantity of suspended and colloidal substances removed by screens, grit chambers, sedimentation and chemical precipitation may be tabulated as follows:

Coarse screens	5 to 10 parts per million
Fine screens	20 to 70 „ „ „
Grit chambers...	10 to 40 „ „ „
Plain sedimentation ...	130 „ „ „
Chemical precipitation ...	290 „ „ „
Activated sludge, more than	290 „ „ „

All of these methods, therefore, leave in the sewage some suspended and colloidal matter, and practically all of the crystalloidal substances. Where further purification is required, methods of oxidation are employed.

The results obtained by bacterial oxidation in sand or stone beds have varied greatly. The best results can be obtained undoubtedly by the use of sand filters with which a clear, sparkling, non-putrescible effluent can be produced without difficulty. Such an effluent is as good as can be obtained by any of the available processes and may contain no more bacteria than a well-disinfected settled sewage.

The activated sludge method produces a clear, sparkling, well-oxidised effluent. Its bacterial efficiency apparently approaches that of the sand filter, as does its power of oxidation and removal of organic matter.

To any one of these methods it is practicable to add disinfection with chlorine, which will reduce the number of organisms to such an extent that the discharge of the effluent into tidal waters, or into large bodies of water from which water supplies are taken and properly filtered and disinfected, should not endanger health.

By available methods it is practicable to produce an effluent of almost any required degree of purification. Local conditions in one place may favour the adoption of one method, while those of some other city may warrant an entirely different process. In general, where large bodies of water are available for dilution, it is unnecessary to adopt artificial means of oxidising the organic matter. While natural resources for the oxidation of sewage should be utilised as fully as is compatible with the general welfare, they should not be abused by the discharge of overtaxing loads of organic matter into streams and waters, by which their value of natural resources is destroyed wholly or in part.

The problem before the engineer to-day is not so much how it is possible to purify sewage as it is to determine to what extent the sewage should be purified to meet the existing conditions and by what process this can be most economically accomplished.

PERSONAL.

Mr. A. Wilson, surveyor to the Ashburton Urban District Council, has had his salary increased by £20 a year.

Mr. Lonergan, assistant county surveyor of South Tipperary, has had his salary increased from £100 to £110 a year.

Mr. Henry S. Ellis, borough electrical engineer of South Shields, has had his salary increased by £50 a year, bringing the total up to £500 per annum.

Mr. Harman, assistant to Mr. M. Hainsworth, surveyor to the Teddington Urban District Council, having joined the Army, Mr. Hainsworth was on Monday authorised to advertise for a general assistant.

Mr. Robert Pierce, M.INST.C.E., municipal engineer of Singapore, is resigning his position, and, in placing on record recently their deep sense of gratitude to him for the services he has rendered, the municipal commissioners resolved to ask his acceptance of a sum of £500.

Major W. T. B. McCormack, of the Australian Expeditionary Forces, who has arrived in this country in command of a company of Engineers, is a well-known civil engineer, and has made a special study of road engineering. He is desirous of getting information on this subject here, and we shall be pleased to forward to him anything helpful that may reach us as to methods, materials, or modern appliances.

Amongst those of the Wimbledon Borough Surveyor's department who have served at the front is Mr. F. Woolhouse, who was formerly in the Marines. He enlisted in September, 1914, and, though suffering from an injured foot, managed to "dodge" the doctor. He was engaged in sniping at Givenchy, La Bassée, where, after accounting for six Germans and

Sergeant-Major Woolhouse.

shooting one whom he left the trench to deal with he was shot by a man concealed behind a haystack, the bullet penetrating his skull, as shown in the accompanying photograph. He was again wounded in three places in the right arm at Aubers Ridge, Fromelles. He has just been appointed Sergeant-Major to the Officers' Training Corps, now quartered in an Eastern town.

OBITUARY.

Mr. John Briggs, burgh surveyor and sanitary inspector of Dumbarton, died, we regret to state, on Saturday last. He carried out many important municipal works during his tenure of office. An enthusiastic volunteer, he was at one time sergeant-major of the Border Brigade Bearer Company. Subsequently he was ambulance sergeant of the Dumbartonshire Volunteer Regiment, and he turned his ambulance knowledge to good account as a commandant of the Dumbarton V.A.D. As a shot he was regarded in his day as one of the Bisley experts.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Banbridge U.D.C.—It has been agreed to effect alterations in a large shed in the market yard, in order to make it suitable for a public slaughterhouse.

Bishop's Castle T.C.—Tenders are to be obtained for alterations to the sheds in the fair ground for the purpose of housing the fire engine.

Hemsworth R.D.C.—The council have approved the plans for a mortuary at Moorthorpe.

Norfolk C.C.—The Eastern Highways Committee have referred to the Bridges Committee a letter from the Aylsham Rural District Council, asking what contribution the county council were prepared to make towards the cost of putting Burgh Bridge into a condition of safety. It appeared that the district council were not liable for the repair of the bridge; it was the property of the Navigation Commissioners, who had no funds in hand. On the one side it was approached by a county council road and on the other by a district council road.

Winchester T.C.—The surveyor, Mr. W. V. Anderson, has received instructions to prepare plans for a public convenience at a cost not exceeding £200.

HOUSING AND TOWN PLANNING.

Petworth R.D.C.—With reference to a circular letter from the Local Government Board asking if there were any building contemplated in the council's area after the war, it was decided to reply that the council contemplated building cottages at Fittleworth, this scheme having been postponed until after the war.

Westhoughton U.D.C.—The Local Government Board have sanctioned an instalment (£3,160) of the sum required for the erection of forty-one working-class houses, and it is proposed to commence work at an early date.

MOTOR TRANSPORT.

Barnoldswick U.D.C.—It is proposed to purchase a Frances motor wagon for the health department, at an estimated cost of £335.

Bristol T.C.—The city council on Tuesday last adopted a recommendation of the Watch Committee to purchase a new motor fire engine for Bedminster, at a cost of £995.

Runcorn R.D.C.—It has been decided to purchase a motor ambulance, at an estimated cost of £535.

PARKS AND OPEN SPACES.

St. Andrews T.C.—It has been agreed to form a new nine-hole putting course on the golf links, at a cost not exceeding £200, the repayment to be spread over a period of ten years.

REFUSE COLLECTION AND DISPOSAL.

Grimsby T.C. It was reported that there was a large accumulation of old tins at the works which could not be disposed of. Before the war a German firm bought all the council could supply.—On the ground that the practice was a menace to health, the Sanitary Committee recently forbade scavengers to sort rags and other material from the household refuse they collected. As a result of this prohibition the men have demanded an increase of pay of 3s. weekly. They assert that the rags, which they regarded as their perquisite, brought them in 4s. weekly per man. At a meeting of the Sanitary Committee the mayor asserted that, despite the committee's orders, the men were still sorting the refuse, and the committee decided to let the application for an increase lie on the table.

Nottingham T.C.—The town council on Tuesday agreed to the purchase of 11 2-5ths acres of land adjoining the Radford gasworks, for the purpose of depot accommodation and the storage of refuse. The price was 2s. 6d. per yard. The Finance Committee were authorised to raise the purchase money, amounting to £4,201, by loan or otherwise. The mayor (Councillor J. G. Small), in moving the adoption of the scheme, said the interest on the money—about £6,200—at 6 per cent, was approximately £370 per year. Mr. Terry, the manager of the nightsoil department, had stated that for £12 10s. per week they could cart the clinker refuse from the destructor, and with this land, at the site available, it could be done for 30s. per week, thus representing a saving of £570 per year.

ROADS AND MATERIALS.

Consett U.D.C.—In addition to certain other proposals it has been decided to include the widening of Victoria-street in the list of works to be carried out after the war.

Doncaster T.C.—It is proposed to proceed with the reconstruction of a portion of the tramway track at Bentley.

Elgin C.C.—A report by a sub-committee of the County Road Board was submitted as to the damage done to the Kellas road by the recent flooding. Various schemes were considered, but the committee recommended that the line of the new road should be adhered to. A further report expressed satisfaction with the progress of the work.

Fifeshire C.C.—The road surveyor, Mr. T. Aitken, estimates that the cost of repairing the roads caused by flooding will be £800.

Frome U.D.C.—It was reported that the county surveyor had consented to the use of limestone on certain roads in the town, being satisfied that there was no stone of the better qualities available.

Helston R.D.C.—The council decided on Saturday to adopt the system of payment of workmen's wages by cheque, on the suggestion of the district auditor, and granted the highway surveyors and sanitary inspector for the north and south districts an increase of salary of 5s. per week for the duration of the war, or until the resumption of normal prices.

Hetton (Durham) U.D.C.—Instructions have been given to the surveyor, Mr. J. Harding, to prepare another scheme for the proposed improvement of Three Tuns-road.

Leake R.D.C.—A committee appointed by the council to consider means to obviate flooding on the Gotham-lane do not recommend any steps for a road scheme which would cost about £100. There is an alternative scheme across the fields, which would cost not much above £10. The matter is now being considered by the parish council.

Newport (Mon.) T.C.—The Parliamentary Committee have passed a resolution in favour of proceeding with the proposed improvement at Cardiff-road and Courtybella crossing as soon as circumstances will permit. The estimated cost of the scheme, exclusive of land, is £25,000. The railway companies have been asked to make a contribution towards the cost.

Nottingham T.C.—The town council on Tuesday authorised the Improvement Committee to take steps to improve the dangerous corner leading from Derby-road to Beeston-road, and the further corner leading from Beeston-lane to Beeston, in such a manner as to make it possible for drivers of wheeled vehicles to see approaching traffic.

Oswestry T.C.—It has been agreed to proceed with the widening and fencing of the bend nearest to the last houses in Whittington-road, at an estimated cost of £73, and that the widening at the further bend in the road be deferred with a view to a grant being obtained from the county council and the Road Board.

Oswestry R.D.C.—The surveyor, Mr. T. H. Davies, reported that he had had an interview with Mr. Brookes, an engineering official of the Road Board, who seemed very favourable towards making a grant towards the repair and improvement of Twmpath-road, and suggested that the contribution should be one-third of the total cost. He (the surveyor) estimated the total outlay at £484, of which £234 was for the work of resurfacing the road. The council decided to ask for two-thirds of the cost.

Oulton Broad U.D.C.—A letter was submitted to the Roads Committee from the East Suffolk County Council with reference to discontinuance of watering

of streets on grounds of economy and difficulty in obtaining labour, the opinion of the county medical officer being that this was a very shortsighted policy, particularly at this season, when the ground temperature was gradually increasing. The association of rises in ground temperature and increases in number of cases of diarrhœa and vomiting in infants was well known, and in view of the fact that it was desired to conserve the infant population he thought councils should be urged to water streets at any rate for the next two months in order to prevent as much as possible the dust and germs being blown about.

Portrush U.D.C.—It has been agreed to steam-roll the roads in the extended area, and to obtain tenders for stones and screenings and also for steam-rolling.

Portslade U.D.C.—In reply to the circular letter from the Local Government Board, as to the proposed execution of works after the war, it was decided to name the widening of Southern Cross cross-roads, and making up of Wellington-road, and also certain private works.

Rugeley U.D.C.—It is proposed to spend a sum of £240 on repairs to the Sheep Fair and Hagley-road.

Teignmouth U.D.C.—Explaining an increase of the half-year's estimate for road maintenance from £395 to £580, the surveyor, Mr. F. W. Knight, stated that he had estimated only for the work that was absolutely necessary. Some of the roads were not re-metalled every year, but this winter it was necessary. These roads could not possibly go another winter.

Tyrone C.C.—The county surveyor, Mr. F. J. Lynam, reported that his estimate for repairing the roads and bridges destroyed by the August storm had been increased from £1,671 to £3,071, but that the temporary work which he was carrying out might last for ten years. He had got some fairly substantial temporary timber bridges finished, and he suggested the adjournment of the question of permanent reconstruction for some time and to limit the immediate expenditure in these cases to £1,000. The council agreed to these proposals.

SEWERAGE AND SEWAGE DISPOSAL.

Auckland R.D.C.—A tender at £152 has been accepted for sewerage works.

Bodmin T.C.—Complaint was made at the council meeting on Tuesday of the condition of the sewage disposal works, and it was decided that the whole council in committee should view the works and see what is required to be done.

Downham U.D.C.—It is proposed to take up a loan of £1,939 for the purposes of the sewage disposal scheme.

Hertford R.D.C.—The Local Government Board have declined to sanction a loan for the construction of sewage disposal works at Tewin.

Holsworthy U.D.C.—The medical officer, Dr. Gray, on Tuesday last again reminded the council that no analysis of the water has been made for five years, and that the sewage system of the town is antiquated, highly insanitary, and quite incapable of being improved. Only a new system and modern sewage disposal works will, he states, remedy the existing defects.

Midlothian C.C.—The Suburban District Committee, having considered in considerable detail the question of surface-water drainage at Corstorphine, decided to ask the Water of Leith Purification and Sewerage Commissioners to appoint representatives to meet representatives of the District Committee to discuss the whole question.

Morley T.C.—It has been agreed to enlarge the press-house at the sewage disposal works by the addition of two presses, at an estimated cost of £970.

Rochdale T.C.—A vacuum gully emptier is to be purchased for the use of the street cleansing department.

WATER, GAS, AND ELECTRICITY.

Conway R.D.C.—Complaint having been made as to the serious condition of the public wells, the sanitary inspector has been instructed to submit a report on the subject.

Dewsbury T.C.—A decision has been reached to provide an additional water supply at Thornhill.

Exeter T.C.—A recommendation of the Cleansing and Lighting Committee to give permission to Exeter Gas Company to substitute a standard of calorific power for a standard of illuminating power has been referred back for further consideration.

Exmouth U.D.C.—The Special Lighting Committee reported that they had met the directors of the gas company, who had accepted an offer of payment in settlement of all claims arising under their contract at the rate of £350 per annum from the date of the order for the extinction of all street lights until the date that the order be revoked, the contract remaining in force as if no order had been made. The committee regarded such a settlement as satisfactory from all points of view, and the council approved the report.

Holmfirth U.D.C.—The council have approved the extension of the electricity mains to Bottoms and Burnlee.

Hythe T.C.—In declining to sanction a proposed loan of £860 for new water mains at Tawner's Hill, the Local Government Board advise the town council to consider whether the money can be paid out of the rates.

Llanelly R.D.C.—The council are asking the Public Works Loan Board for a loan of £34,883 in connection with the water supply undertaking now being carried on under the provisions of the Llanelly Rural District Council Act, 1912. This Act authorised the council to borrow £179,483 and any further moneys the Local Government Board might sanction. Owing to the war a good many of the works were closed down, but a large quantity of water is required at Pembrey; hence the application.

Newport (Mon.) T.C.—The Electricity Committee and Waterworks Committee recommend that a war bonus of 3s. per week be paid to their employees, skilled or otherwise, if over twenty-one years of age.

Oswestry T.C.—The borough surveyor and engineer has called the attention of the town council to the serious position of the town in the matter of the water supply. In reference to this the mayor (Mr. R. S. Parry) stated that there was only about a week's supply in the reservoirs. They were getting 250,000 gallons a day from the Liverpool supply, this being the amount they were allowed to receive by Act of Parliament. The consumption the week before last was at the rate of 392,000 gallons per day. There was a lot of water being wasted at the present time. It had been suggested that they should turn the supply off at night time, but his opinion was that more water was lost when that was done than if it was not cut off at all. It was agreed that a meeting of the Water Committee should be convened to discuss the situation.

Oswestry R.D.C.—A committee has been appointed to visit Middle Hengoed to ascertain if temporary steps can be taken to deal with the water supply.

Paul U.D.C.—In connection with the report by Messrs. Douglas, Lewis & Douglas, with respect to the water supply, it is proposed to sink a well and take an analysis of the water.

Plymouth T.C.—The three water undertakings of Plymouth, Devonport, and Stonehouse showed on last year's working a nett profit of £5,690.

Plympton R.D.C.—The Water Committee have been authorised to carry out the necessary works in connection with the leakage at the reservoir, at an estimated cost of £150.

South Shields T.C.—The total revenue of the electricity undertaking last year was £90,757, a decrease of £3,745 compared with the previous year. With reference to the capital expenditure a member stated that it totalled £225,000, and the contributions to the sinking fund amounted to £105,000, so that altogether the concern was in a very comfortable condition.

Swansea T.C.—The Electricity Committee reported that negotiations had been opened with the Harbour Trust with a view to all the electrical energy required at the docks being supplied by the corporation in the same way as it is now supplied to the tramways undertaking. It was decided to extend the central works at a cost of from £20,000 to £25,000.

Wolverhampton T.C.—The nett profit of the electricity undertaking last year was £1,586, which has been transferred to the reserve fund.

MISCELLANEOUS.

Carnarvon T.C.—With regard to street lighting under the new order the Lighting Committee reported having met the chief constable, who had promised to give his consideration to suggestions for keeping

certain lamps alight from two hours after sunset till midnight, in addition to four corner lamps which he had already approved. There was also a proposal by the committee to have lamp-posts painted white. A discussion arose as to the relative merits of painted lamp-posts and whitewashed kerbstones as a means of guiding pedestrians at night, and eventually the question was referred to the Lighting Committee for decision.

Dorchester R.D.C.—It has been agreed to apply for exemption from military service for Mr. J. J. Estridge, the highway surveyor.

Gateshead T.C.—The town council have approved a report of the Town Improvement Committee stating that they did not see their way clear to recommend the council to approve the promotion of the suggested Bill for the linking up of the tramways systems of Newcastle and Gateshead by means of tramways across the high-level bridge until such Bill has been considered by the council, and all proper provisions which the council may think necessary to safeguard the interests of Gateshead have been inserted therein.

Hartlepool T.C.—In reply to the Local Government Board inquiries regarding public works to be started after the war, the town council have decided to state that they propose to proceed with their housing scheme, and other probable works are the proposed extension northwards of the promenade, the protection of the cliff to the south of the promenade, and the provision of a new school at Throston; while reference may also be made to a project for a tunnel under the channel between Hartlepool and Middleton, or for a bridge over it.

Salford T.C.—The nett profit of the tramways undertaking last year was £18,473, and in order to permit of the promised payment of £22,000 in relief of the rates, £3,526 has been transferred to the current account from the depreciation and renewals fund. The balance remaining in the depreciation fund is £21,266. During the year £13,135 was disbursed in allowances to the families of men who are in the Army.

Teddington U.D.C.—The surveyor, Mr. M. Hainsworth, has purchased a 3-h.p. gas engine for the workshop at the sewage works for the sum of £12.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BARTON-ON-HUMBER URBAN DISTRICT COUNCIL.

SURVEYOR AND INSPECTOR OF NUISANCES.

The above Council are prepared to receive applications for the post of Temporary Surveyor and Inspector of Nuisances. Population about 6,000.

The person appointed must be fully qualified, and be ineligible for the Army.

The appointment will be made for the duration of the war only, or until the return of the Council's permanent Surveyor, and will be subject to the sanction of the Local Government Board.

Applications, in own handwriting, stating fully age, qualifications, salary required, and when can commence duties, with copies of not more than three recent testimonials, to be sent to the undersigned so as to reach him not later than the 30th September, 1916.

Canvassing will be a disqualification.

G. H. NOWELL,
Clerk to the Council.

Barton-on-Humber,
Lincolnshire.
September 12, 1916. (3,093)

BOROUGH OF BEDFORD.

TEMPORARY ENGINEERING ASSISTANT.

Wanted, in the Borough Engineer and Surveyor's Office, a Temporary Engineering Assistant (ineligible for military service) for the duration of the war.

Applications, in candidate's own handwriting, stating age and salary required, and giving full particulars as to experience, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, September 30th.

Canvassing will disqualify.

N. GREENSHIELDS, ASSOC.M.INST.C.E.,
Borough Engineer and Surveyor.

Borough Engineer and Surveyor's Office,
Town Hall, Bedford.
September 12, 1916. (3,097)

BOROUGH OF BEDFORD.

WATER INSPECTOR.

Wanted, in the Waterworks Engineer's Department, an Assistant Water Inspector (ineligible for military service).

Candidates must be qualified plumbers, capable of laying and repairing water mains, services, fittings, &c., and experienced in the management of men.

Wages 40s. per week, in addition to which a temporary war bonus of 5s. 6d. per week will be paid during the period of the war.

Applications, in candidate's own handwriting, stating age and giving full particulars of experience, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, September 30th.

Canvassing will disqualify.

N. GREENSHIELDS, ASSOC.M.INST.C.E.,
Waterworks Engineer.

Waterworks Engineer's Office,
Town Hall, Bedford.
September 12, 1916. (3,096)

RURAL DISTRICT COUNCIL OF FAREHAM.

LEE-ON-THE-SOLENT MAIN SEWERAGE.

CLERK OF WORKS REQUIRED.

The above-named Council invite application for the appointment of a Clerk of the Works in connection with the completion of the Lee-on-the-Solent Main Sewerage, which consists of about 2½ miles of sewers.

The duties will include the Superintendence of all House Connections to the sewers, and supply all necessary information to the Council in connection therewith.

Considerable experience in the supervision of Sewerage Works is essential, and the Candidate must be able to Test Materials, Set out Work, use the various Surveyor's Instruments, and Measure all work done.

The person appointed will be required to work under the direction of the Engineer, Mr. Wilberforce Cobbett, ASSOC.M.INST.C.E., and to devote the whole of his time to the work during the Contractor's working hours. The work is expected to last nine months, and the appointment will be subject to one month's notice on either side.

The salary will be 3½ guineas per week.

Applications, endorsed "Clerk of the Works," stating age and qualifications, accompanied by copies of three recent testimonials, to be sent to the undersigned not later than 10 o'clock a.m. on Friday, the 22nd inst. The successful applicant will be required to reside at Lee-on-the-Solent.

Applicants who canvass any Member of the Council, either directly or indirectly, will be disqualified.

(By order)
ALFRED LAKER,
Clerk to the Council.

97 West-street, Fareham, Hants.
September 12, 1916. (3,095)

COUNTY BOROUGH OF SOUTHEND-ON-SEA.

The Corporation of Southend-on-Sea invite Tenders for the Supply of Coal for a period of one year from 1st October, 1916.

Form of Tender may be obtained on application to Mr. Ernest J. Elford, Borough Engineer and Surveyor, Municipal Buildings, Southend-on-Sea.

Sealed Tenders, endorsed "Tender for Coal," to be delivered at my Offices not later than 9 a.m. on Thursday, 21st September, 1916.

No Tender will be considered unless made on the prescribed Form.

The Corporation will not be bound to accept the lowest or any Tender.

(By order)
H. J. WORWOOD,
Town Clerk.

Town Clerk's Office,
Southend-on-Sea. (3,098)

FULLY QUALIFIED SURVEYOR seeks Appointment. Would undertake Temporary Work.—Apply Box 1,585, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,094)

THE DISPOSAL OF EXCRETA IN THE TROPICS.*

By ANGUS MACDONALD, M.D., D.P.H., D.T.M.,
Medical Officer in Charge of the International Health Commission, Grenada.

The advent of the International Health Commission with its initial crusade against hookworm infection has emphasised the sanitary necessities of the tropics. For ankylostomiasis is a disease of tropical conditions, and attack upon it is a matter of tropical sanitation. Being a disease of soil infection, it is essentially a disease of the country, and it is to the country parts especially that attention has to be directed. . . .

In the main, without entering on debatable problems which will be solved when sufficient data are brought forward, it must be conceded that the bare-footed individual, no matter of what race, age or sex, brought in contact with hookworm-polluted soil is in the fair way to hookworm infection. The prevention of soil pollution realised, therefore, the problem is restricted to the disposal of human excreta in manner suitable to attain that end without detriment to the preventive aims already secured for other purposes. There does not appear so far to have been any serious consideration given to this aspect of the disposal of excreta, though practical sanitarians, wherever hookworm treatment on a large scale has been undertaken, have been forced to adopt such measures to prevent soil pollution as seemed locally suitable. . . .

Abundant detail . . . is given of different forms of closet or latrine, but scant consideration is given to the actual disposal of the excreta. The main preventive purposes in view in any system of disposal have been the removal of a nuisance and the prevention of personal, fly, and water infection of cholera, dysentery, enteric. Even then, theoretical sanitarians have been content to give their assent in favour of this, that and the other perfect type of closet, not considering cost and satisfactoriness of ultimate disposal.

Legislation also within my knowledge in different colonies has ordained with elaborate detail a special type of closet and left altogether out of account that the daily emptying which was obvious had to be arranged for in some safe manner.

CUSTOMARY METHODS OF DISPOSAL.

It may be useful to review briefly the customary methods of disposal throughout the tropics. I sum them up under four heads . . .

(1) Water carriage. (2) Human carriage. (3) Original permanent disposal. (4) Natural disposal.

(1) Water carriage usually implies direct transport of excreta from closet to deposit in sea, on farm or on treatment beds. But the sewers may be used for subsidiary conveyance of the contents of buckets pails, utensils, deposited at intakes from institutions or at other authorised situations. This minimises the preventive advantages of a sewerage system by retaining an amount of personal handling of utensils. . . .

(2) Human carriage is to be used to include that large variety of latrine service, the principle of which is local deposit in pan, bucket, tub (commonly), on ground surface (frequent, in which case, crabs, beetles, ants, rat, dog and vulture may perform the disposal); in vault or pit under or near dwellings (Bombay, Barbados, Panama); in large concrete vaults (China, Accra); in pits (Jamaica and South American cities), followed by daily or at least frequent removal. It is obvious that no matter how speedily local nuisance and danger may be removed, without special disposal arrangements soil pollution will take place. For, in spite of its poor manurial value, human excrement all over the world is regularly destined for soil enrichment.

(3) Original permanent disposal is typified in the pit of the desert, the Arab well, and is seen in the deep pit which is not emptied for years at a stretch (Kingston, Jamaica, and several South American cities), and in the septic tank which may be found in some countries directly under the dwelling and in others somewhat removed. In these types soil pollution is practically obviated.

(4) Natural deposit may be asserted of the method adopted amongst rural populations all over the world. Undoubtedly, this leads to the most intense soil and water infection.

From this brief and undetailed survey of methods it may be acknowledged that the sewerage system with deposit in sea and the original permanent deposit (deep pit and septic tank systems) are the only methods that satisfy the postulate the prevention of soil pollution. It will no doubt at once be conceded that a sewerage system conserves as far as possible the other demands of preventive medicine.

I claim the same concession for the deep pit, and recognise the sewerage system (with deposit in sea or by other method of preventing soil pollution) as the ideal system for town, the deep pit system the ideal for the country. Later I shall detail my reasons for supporting the deep pit. To consider the methods that will secure the prevention of soil and water pollution, there would appear to be but two practicables: (1) Destruction of excrement, and (2) safe deposit of excrement.

(1) Destruction may be brought about by (*a*) heat and by (*b*) chemicals. (*a*) Incineration is satisfactory only where the container is destroyed in the general combustion or is cleansed in the process. In the former method combustible utensils of wood pulp and various compositions, or readily destructible vessels of clay or metal may be used; in the latter weighty buckets of metal that will withstand repeated and continued heating are required. These methods may both be adopted in institutions, but cost and labour prohibit their domestic availability. The dangers incident on the frequent handling of infected vessels are still present.

(*b*) Chemical destruction of fæces (on the domestic scale) may be possible superficially, but the integrity of the inner part of solid excrement will probably be preserved through any possible domestic chemical treatment. The known destructive and inhibitive action on hookworm ova and larvæ of common salt has so far as I am aware been put to no practical use, unless mere disposal in sea may be so regarded.

SALT AS A DEODORANT.

As a result of practical observation on the wholesale use of salt along with series of laboratory experiments, I am of opinion that a very valuable chemical destructive agent may be obtained by a mixture of equal parts of salt and sand added in usual amount (2 or 3 to 1) to fæcal deposit in bucket or pit. The deodorant effect is more satisfactory than that of dry earth, ashes or lime, and in the case of the bucket a saline film (in a moderately humid atmosphere) remains about the metal, which renders cleansing simple and prevents adherence of fæces and odour. Although laboratory experiment has given evidence of destructive permeation of the fæcal mass by the salt, this fact alone would not justify surface disposal of infected fæces which had only a twenty-four hours' exposure to the saline mixture, as would be the case ordinarily with the domestic bucket. Still, where buckets have to be used the salt mixture has valuable properties, and, as a matter of additional safety, might compensate for the inevitable occasional mis-disposal of the most carefully tended bucket systems. The use of salt also repels flies. Certainly where salt can be produced cheaply and abundantly it should be as readily attainable as dry earth, and is preferable. All things considered, I cannot be said that the domestic destruction of excrement is a feasibility for the general population.

(2) We have conceded that water carriage with deposit in sea ensures safe deposit from a broad hygienic outlook as well as from the limited demand for the prevention of soil pollution in respect of hookworm infection. For practical purposes also a well ordered sewerage system, where the sewage is utilised on a sewage farm or subjected to some specific treatment, may be regarded in the light of safe deposit. For it must not be overlooked that the amount of hookworm infection in an urban community is initially small, and in a sewered city the immigration of infected rustics would be fraught with little danger to the other town dwellers. . . .

THE DEEP PIT CLOSET.

The question to be faced is the provision of the means of safe deposit of human excrement for the ninety and nine of the rural population. As affirmed above, I believe the deep pit closet is the only system of latrine service that in general is likely to supply the demand. I contend for its advantages in general and readily concede its drawbacks in particular. But, accepting the idea communities by hook latrine, and

* From the *Journal of State Medicine* for September.

artifice may succeed in accommodating it to local conditions of any variety. The only alternative for the populations under consideration is some type of bucket closet. This inevitably means human handling and as inevitably means a pit for safe deposit. Shallow pit or trench deposit is useless to prevent soil pollution. . . .

Above all things the avoidance of human interference should be recognised as a first principle in all such matters of domestic sanitation. The ideal soil on which to construct the deep pit closet is sand, shingle or gravel. In these situations within the tropics such closets are the natural systems adopted, and they have proved their advantages and dangers throughout centuries. No doubt cholera may have been propagated by them in the Arabian desert, and enteric may have come from them in Jamaica before the days of pipe-borne water. The very deep pit of the desert does not harbour flies, nor does the deep pit of Jamaica. Musca is not allured 6 to 12 or many more feet down a pit containing gases evolved from fæcal decomposition, though there may be some attraction when the deposit approaches the top. Nuisance then becomes apparent and the householder is anxious to have the condition changed. The pit is then filled up and a new one constructed, or it is emptied and the matter buried elsewhere.

The deep pit dug in gravel or sand may be from 8 to 12 or many more feet in depth, with a section of 6 by 4 ft. rectangular, or a corresponding diameter if circular. Its sides may be lined with brick or stone dry set, and the bottom may be left unlined to allow of ready drainage. A storm-water wall, rising some 9 to 12 in. above ground level, will support the wooden erection above the pit. Where the pit is designed to be emptied periodically, the house and flooring are joined together and tilted over on the ground behind during the emptying process. The same building also can be lifted and placed over a new pit.

From data collected over four and a half years recently in Kingston, Jamaica, the life of a reasonably cared-for pit closet, some 8 to 10 ft. deep, and 6 ft. by 4 ft. in section, and contributed to by a fair population, was eleven years. Nuisance is slight if drainage is good and entrance of storm-water is prevented. The condition is otherwise if these essentials are neglected. The freedom from nuisance, the very slow rate at which it fills, and the rapidity of poudrette formation are striking features of the really deep-dug pit in the tropics.

It must be borne in mind, and I wish to emphasise it, that there is absolutely no comparison between the deep pit closet and the common privies and privy middens of England. . . .

To summarise briefly the points considered:—

(1) The disposal of excreta in the tropics should, in addition to the other essentials, secure the prevention of soil and water pollution.

(2) Means of safe deposit may be attained by deposit in sea, incineration, and burial.

(3) Deposit in sea may be by means of water carriage or (less satisfactorily) by human carriage.

(4) Incineration is of value, but is not a practicable means for the general population.

(5) Burial may be secured in the cesspit or septic tank, the deep pit closet, or in a pit into which the domestic pail or other utensil is daily emptied.

(6) The safe handling of utensils and safe deposit from them is impossible to enforce by any authority, and is barely practicable for the individual.

(7) For the general population, the deep pit closet, lasting ten or twelve years, or a pit closet of smaller dimensions filled and dug anew at frequent intervals, offers the safest solution of the problem.

(8) The disadvantages of the pit closet are: (*a*) Nuisance from odour if excreta are not systematically covered over, or if storm-water gains access. (*b*) Danger from fly infection—a rare possibility in the deep pit—less improbable in the shallow. (*c*) Mosquito breeding—a rare possibility. (*d*) Possibility of pollution of sources of water supply.

Suitable education of the people and an efficient sanitary system should overcome these disadvantages.

Professor Turner and Summer Time.—Professor H. H. Turner, F.R.S. (Oxford University), in a paper on "The Measurement of Time," read at the recent meeting of the British Association, said that the new system of summer time, though it had met with some opposition from astronomers, had proved of great advantage to the public, and he hoped it would be made permanent—not merely for the duration of the war, but for the indefinite future.

EXPERIENCE WITH WOODEN WATER-PIPES.*

By Arthur W. Dudley,
Manchester, New Hampshire.

Wooden water pipes, when encountered in street excavations, are invariably found to be entirely free from decay. These ancient pipes were bored logs, and in their manufacture the very best part of the timber —namely, the heart—was removed. It may be asked why, if wood pipe was so durable, should cast-iron or any other material be substituted? The answer to that question is that the old method of making a wood pipe limited its inside diameter to the size of the log, and therefore large pipes were both expensive and usually impracticable; 6 in. inside diameter was nearly the limit of such pipe. By the modern method of making wood pipe the diameter is practically unlimited, and it has been made in the continuous form up to 10 ft. in diameter.

The two forms of wood pipe in common use are the continuous pipe, built of staves, breaking joints, put together in the trench, and what is termed "machine made." This latter is made in lengths of from 3 ft. to 14 ft., and shipped to the work ready to be laid. The staves are about 2 in. in thickness, and cut true to the circle of the diameter of the pipe. These staves have two beads upon each longitudinal edge, and two corresponding grooves in the other longitudinal edge. The beads are slightly larger than the grooves, and when pressed together the bead crushes into the groove, this making it perfectly watertight. At one end there is a tenon 4 in. long where the staves are one-half the thickness of the balance of the walls of the pipe. On the other is a chamber cut 4 in. deep. The tenon is slightly smaller in diameter at the end than at the shoulder, so that when driven into the chamber it makes a watertight joint. These staves, cut radially to correspond with the diameter of the pipe, are held together by a steel band, either flat or round, wound spirally upon the pipe by a machine. The high tension of this band forces the beads into the grooves, making a longitudinal joint that cannot leak so long as the elastic limit of the bands is not overcome. After the pipe is wound, and the tenon and chamber cut, it is rolled in a bath of asphalt that adheres to the outside of the steel and wood, protecting them from oxidation. Usually a second coating of asphalt is applied. It is then rolled in a bed of sawdust that forms a protection for it in shipping and handling. It is laid by driving one piece into another until the shoulders are in close contact. This form of pipe is made for diameters from 3 to 36 in.; the larger pipes are made in the continuous form.

The eastern [United States] manufacturers make their pipes of the best obtainable Canadian pine. The Pacific Coast pipe is made of Douglass fir and redwood, and is banded with round steel wire, instead of flat steel, and differs also in that the pipes are all made with tenon ends, that are connected with sleeves, 6 to 8 in. in length. The manufacturers claim that this method of connecting gives greater strength to the pipe line, and also that Douglass fir and redwood is a stronger material than pine. The writer, however, after experimenting with both forms of pipe, came to the conclusion that, while the claim that the sleeve method of connection may be stronger, the difficulty in coating the exposed ends of these sleeves, and the fact that they would not be saturated at all times, exposed them to greater danger from decay. Also that, while Douglass fir might, and probably does, possess greater tensile and crushing strength than pine, its greater brittleness exposes it to more danger from water hammer, and for these and other minor reasons has given the preference to the tenon and chamber, flat-hooped pipe. This form of wood pipe was first laid in New Hampshire in 1895, at Penacook, a suburb of Concord, and this system was afterwards connected with and incorporated into the Concord water system. The Antrim water system, constructed in 1896, is a gravity system; its source of supply is some three miles from the village, and the head is slightly over 200 ft. The entire system, both supply and distribution pipes, is of wood. The writer on several occasions during the past few years has uncovered and examined pipes in this water system, and has invariably found them as perfect as when laid; the leakage here, as in all wood pipe lines that he has had to with, is infinitesimal.

Other water systems, most of them designed and

* From a paper read before the New England Waterworks Association.

constructed by the writer, are: (1) Campton Village, where the head is 186 ft. and the supply pipe 12 in. and 10 in.; the distribution pipe, 8 in. and 6 in. in diameter; this was constructed in 1905. (2) Freedom, New Hampshire, constructed in 1912, with a head of 300 ft. Both of these systems have no apparent leaks and have cost next to nothing for repairs since their installation. Bristol, New Hampshire, has a 20-in. wood pipe supply line connecting the village distribution system with the source of supply. Laconia, New Hampshire, has a wood pipe intake line laid 400 ft. into Lake Winnepesaukee, connecting with the pumping station. Hudson, New Hampshire, has an 8-in. supply line, and the writer's firm is this season constructing two water systems with wood pipe supply line, one with a 4-mile distribution line, in a suburban street. The smaller system is at Troy, New Hampshire. The source of supply is a small stream that has its source in the west slope of Mount Monadnock, and this wood supply line, some four miles in length, is of 12-in. and 10-in. pipe, the head is 310 ft., the distribution system is to be cast-iron pipe. This is now in progress of construction, and is about three-fourths completed. The wood pipe used is of the Michigan pattern

SOME ADVANTAGES.

To sum up the situation, wood pipe has, besides the saving in cost of both pipe and installation, these advantages:—

(1) It is preserved by water, and not rusted or corroded by it.

(2) It is not corroded by any substance, or destroyed by acids or salts.

(3) Its carrying capacity is 20 per cent greater than cast-iron pipe, and remains constant, while that of metal pipe decreases with age.

(4) It does not taint or affect fluids going through it.

(5) It does not burst if frozen, the elasticity of the wood preventing it.

(6) It requires less labour and experience to lay in place than metal pipe, and a considerable saving can be made here.

(7) It can, when service pipes are not taken off, be laid in shallower ditches than metal pipe, for it is not so easily affected by frost.

(8) In the writer's experience, while more or less joints show slight leakage when the pipe is first filled, they soon swell up and give less trouble in the end than cast-iron pipe.

THE ACTIVATED SLUDGE PROCESS.

AN AMERICAN COMMITTEE.

At Pittsburg recently, members of the American Society of Civil Engineers met informally to discuss various problems in connection with the treatment of sewage by the activated sludge method. A report of the acting secretary, Mr. T. Chalkley Hatton, stated that the time had not yet come for effecting a permanent organisation to avoid duplication of experiments in the United States and Canada and preventing control of the activated sludge process by patents issued without complete information having been submitted to the commissioner of patents.

Believing that the best results could be obtained through a committee and personal service, Messrs. F. A. Dallyn, provincial sanitary engineer, Toronto; George T. Hammond, engineer of designs, Borough of Brooklyn, New York City, and T. Chalkley Hatton, chief engineer of the sewerage commission, Milwaukee, were appointed to prepare standard definitions and other terms relating to the activated sludge process of treating sewage. They will also tabulate and distribute a summary of work now being done or contemplated, and suggest such correlation of current work as may be desirable.

The question of submitting to the commissioner of patents information relating to priority of knowledge of the activated sludge process was left with Professor Earle B. Phelps, Messrs. H. W. Clark, and George T. Hammond, and Dr. Edward Bartow, with the understanding that all members present should assist by giving the commissioner all possible information in affidavit form.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

CAMP SCAVENGING.

COUNCIL OR MILITARY CONTROL?

At the meeting recently of the Oswestry Rural District Council, the chairman, Mr. N. W. Wilthew, read a report of the Scavenging Committee in which it was stated that the debit balance on the work of scavenging the camp, including an initial loan of £250 from the council, had now been reduced to £161. The War Office had intimated their intention of taking over the whole of the scavenging work after the military vacated the canvas camps this autumn. The committee had decided, in view of the fact that a big initial expenditure had been recouped, to offer to continue the work in the meantime at a charge of 2s. per 100 men per day.

Mr. Peate, who is chairman of the Sanitary Committee, said that the council had previously charged 3s. per 100 men per day, but they now found they could do the work remuneratively at 2s. He did not want to criticise the War Office, because, in ordinary circumstances, they ought to do the work, but he did think that while the war lasted they would be well advised to retain the council's services for the work. The Scavenging Committee had gone carefully into figures and had found that the revised price they were now able to charge would result in a saving on the books of population in the camp of £2,700 a year. But that alone was not the most important thing. It was the intention of the War Office to bring 100 able-bodied soldiers to do the work which they, as a committee, were very well able to do with twenty or even less men over military age. He did think in a time like this, when there was a great scarcity of men of military age, and local tribunals were being urged to send more, it was a great mistake on the part of the War Office to do that work. While it was not within the province of the council to dictate to the War Office in any shape or form, he was sure they were acting unwisely, both from a monetary and military point of view. It was only right he should point out that the committee and the scavenging superintendent had been complimented by the people concerned on the way in which they had carried out their work. Answering a question by Mr. Lovett, Mr. Peate said that, as far as the committee's experience went the destructors now at the camp were extremely unsuitable. There were altogether six groups of four destructors each, and it involved almost as much carting to those destructors as to the fields outside the camp. If the destructors were used, the consumption of coal, especially in the winter, would be enormous. Still, it was the way of the War Office, and the council had no means of getting their voice heard in the matter.

Mr. Boughey said he hoped the council would do their utmost to have the sewage matter properly destroyed instead of putting it on the land. He thought the present destructors should be substituted by destructors of a more powerful capacity.

Dr. Beresford said these would cost about £5,000 each.

The chairman said the position was this, that as far as the council knew, within quite a short period their contract for dealing with the scavenging work at the camp would be terminated and the War Office would carry out the work themselves. It was not for the council to dictate to them how they should do it. They must wait, and if they subsequently found that the camp, being in their sanitary area, gave rise to a nuisance then they would be able to step in.

Mr. Peate said the committee did not want to be kept "tinkering" about while the War Office were making up their minds, and the subject of giving them a month's notice to terminate their contract was being dealt with.

The report was adopted.

Sanitary Association of Scotland.—At the annual meeting of the Incorporated Sanitary Association of Scotland last week, the president, Mr. Robert Lambie, Larkhall, relinquished office, and was succeeded in the chair by Dr. Alexander Robb, while the following were elected vice-presidents: Messrs. F. G. Holmes, Office of Public Works, Govan; and John Frew, sanitary inspector, Linlithgowshire. Mr. Holmes is president-elect, and Mr. George Middleton, Glasgow, was re-elected secretary and treasurer. The annual report, which showed the membership to be 444 and the financial position satisfactory, was adopted.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

District Chairman—Mr. J. S. Pickering, M.Inst.C.E., Borough Surveyor, Cheltenham.

SOUTHERN DISTRICT MEETING.

A Southern District meeting is to be held at Bristol to-morrow (Saturday).

Programme.

11.30 a.m.—Assemble at the Council House.

District Meeting.

Election of District Committee.

Informal discussion on papers describing works to be visited.

1 p.m.—Luncheon at Stuckey's Restaurant. (Tickets 2s. 6d. each.)

Drive to the Suspension Bridge, Clifton and Durdham Downs, Eastville refuse destructor, Barton Hill Baths, inspecting *en route* six sections of bituminous road construction laid during the last four years. (Tickets for conveyance, 3s. each.)

6 p.m.—Tea at Stuckey's Restaurant by invitation of the city engineer.

F. R. Phipps,
Hon. District Secretary.

Borough Surveyor.
Basingstoke.

EAST MIDLAND DISTRICT MEETING.

District Chairman—Mr. E. G. Mawbey, M.Inst.C.E., Borough Engineer, Leicester.

An East Midland District Meeting will be held at Melton Mowbray on Saturday, September 23rd.

Programme.

2.0 p.m.—Meet at Colles Hall, where the members will be received by the chairman of the urban district council, Councillor Sholto H. Sikes, Esq., J.P.

District business.

2.30 p.m. Paper, entitled "The Municipal Works of Melton Mowbray," by Mr. Edmund Jeeves, surveyor to the urban district council, to be followed by discussion.

4.0 p.m.—Tea, by kind invitation of the chairman of the council.

4.30 p.m.—Walk to destructor pumping station.

5.0 p.m.—Walk to Sewage Disposal Works.

5.45 p.m.—Return to Melton by way of Cattle Market. (The distance to be walked is about a mile each way.)

In order that the necessary arrangements may be made, members intending to be present must give notice of their intention not later than Saturday, September 16.

W. H. A. Court,
Hon. District Secretary, pro tem.

Borough Surveyor's Office,
Leicester.

NORTH-EASTERN DISTRICT MEETING.

District Chairman—Mr. J. P. Wakeford, M.Inst.C.E., City Engineer, Wakefield.

A North-Eastern District meeting is to be held at Wath-upon-Dearne on Saturday, September 30th.

Programme.

10.15 a.m.—Meet at waterworks pumping station, adjoining Wath-upon-Dearne (G.C.Rly.) Station, and five minutes' walk from Wath-upon-Dearne Midland Station. Proceed to inspect the plant.

10.30 a.m.—Walk alongside the G.C. Railway to the new sewage disposal scheme in course of construction.

10.45 a.m.—Proceed to inspect the sewage disposal works.

11.30 a.m.—Proceed by motor 'buses from near Messrs. Stanley's oil works at Common-lane, along the main road *viâ* Barnsley-road and Brampton to Wath Wood reservoirs to inspect works there recently carried out. *En route* inspections will be made of the public baths, mortuary, sections of Tarmac roads, and private street works.

12.45 p.m.—Leave reservoirs by motor 'bus.

1 p.m.—Lunch at the Red Lion Hotel.

2.15 p.m.—Proceed to town hall, where the institution will be welcomed by the chairman of the urban district council, Councillor Chas. Adkins, J.P.

Business:

(1) Minutes of last meeting.
(2) Correspondence.
(3) Election of executive committee.
(4) Any other business.
(5) Orphan Fund and support from N.E. District.
(6) Paper on "Notes of Municipal Works and Statistics in the Urban District of Wath-upon-Dearne," by Mr. J. H. Drew, M.Inst.C.E.I., M.R.San.I. (Member), engineer and surveyor to the urban district council, Wath-upon-Dearne, will be discussed.

5 p.m.—Tea at the Red Lion Hotel, by kind invitation of County Councillor Richard Payne, member of the Wath-upon-Dearne Urban District Council.

In order that the necessary arrangements may be made, members intending to be present must give notice of their intention not later than Monday, September 25th.

EASTERN SUB-DISTRICT MEETING.

District Chairman—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer, Middlesex.

An Eastern Sub-District Meeting (Norfolk, Suffolk and Cambridge) will be held at Stowmarket on Saturday, the 30th September, 1916.

Programme.

11.30 a.m.—Meet at the Stow Board Room (Market-place) where Mr. A. E. Ellis, J.P., chairman of the Stowmarket Urban District Council, also chairman of the Joint Sewerage Committee, will receive the members.

Read minutes of previous meeting.

Paper on "Municipal Engineering Work at Stowmarket," by Mr. Gerald W. Lingwood. (Copies of paper will be sent to members who signify intention of attending.)

1 0 p.m.—Lunch at the Fox Hotel. (Tickets, 2s. 6d. each.)

2.15 p.m.—Inspect sewage works, main sewage pumping station, waterworks, electric light works, Combs electric sewage pumping station and Combs waterworks.

4.30 p.m.—Afternoon tea at the Fox Hotel, by invitation of Mr. G. W. Lingwood.

It is suggested that members wishing to bring forward matters for private and informal discussion—such as questions of practice, construction, by-laws, &c., should mention this to Mr. Mead early in the meeting.

Opportunity for inspecting works and places of interest will be afforded members who arrive at Stowmarket during the morning and have mentioned their desire to do so when sending notice of their intention to be present at the meeting.

All members of the institution are cordially invited to attend. In order that the necessary arrangements may be made members must give notice of their intention to be present as soon as possible, and not later than Saturday, the 23rd inst.

John R. Mead,
Hon. Sub-District Secretary.

Ipswich.

MUNICIPAL TRAMWAYS ASSOCIATION.

ANNUAL MEETING PROGRAMME.

The annual meeting of the Municipal Tramways Association will be held at the Surveyors' Institution, Westminster, on Thursday and Friday, September 21st and 22nd.

The proceedings will open at 11 o'clock on the Thursday, when Mr. Peter Fisher, general manager of the Dundee Corporation Tramways, will deliver his presidential address.

The following papers will be submitted for discussion:—

"Some Notes on Passenger Transportation in Large Cities," by Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways.

"Utilisation of Tramways for Goods Traffic," by Messrs. G. W. Holford, general manager of the Salford Corporation Tramways, and W. Clough, general manager of the Bury Corporation Tramways.

The Surveyor

And Municipal and County Engineer.

Vol. L. SEPTEMBER 22, 1916. No. 1,288.

Minutes of Proceedings.

Housing After the War.

Some time ago we called attention to a conference on the general subject of housing after the war, which was held under the auspices of the National Housing and Town Planning Council and in particular on the necessity for municipalities being prepared with adequate schemes for the erection of workmen's dwellings. With a view to bringing the resolutions passed at the conference to the notice of the Government, a deputation was received on Wednesday afternoon by Mr. Walter Long, the President of the Local Government Board. The first resolution directed attention to the critical need for the provision of additional housing for the working classes, and, in view of the national interest and responsibility in the matter, urged upon the Government to set aside a sum of £20,000,000 to make such advances to local authorities and other agencies to enable them to provide houses at reasonable rentals. In support of this the deputation pointed out that it is beyond question that the number of houses built annually for the past few years has not sufficed to meet the normal needs of the population, so that immediately prior to the war there was a pronounced shortage of accommodation. This shortage will inevitably be accentuated by the war, for not only has the building of new houses practically ceased during the past two years, but there has been a very considerable increase in the marriage rate. The question therefore arises as to whether private enterprise can reasonably be expected to provide for the deficiency? It is feared that the answer to this question is a negative one; and if this fear be justified, it follows that municipal building will have to be undertaken on a much larger scale than hitherto. A further reason, if one be needed, for immediately proceeding with the preparation of schemes is to be found in the desirability of being prepared in advance to meet a possible crisis of unemployment in the building trade.

It may be assumed, therefore, that municipal building on an extensive scale will be necessary if after-war conditions are to be met satisfactorily; while at the same time the increased cost of materials and the high price of money will render it more impossible than ever to provide cottages at economic rents without being a charge on the local rates. In suggesting Government grants in aid, the deputation were only asking them to follow the precedent already set in the framing of the terms for lending the four millions provided under the Housing (No. 2) Act, 1914, and to continue the practice of the Treasury in regard to loans for the provision of houses for munition workers. The immediate practical step suggested was that the Housing Departments of the Local Government Board for England and Wales and the Local Government Board for Scotland should be brought into full activity in order that the Government may, through these departments, stimulate local authorities and other agencies throughout the kingdom to place in hand without delay the preparation of schemes. The deputation also referred to the question of town planning, and in this connection urged that housing schemes should not be undertaken in any district without reference to its town planning requirements. There can be no doubt that it is desirable that in all future housing schemes the areas on which the houses are to be built should be properly planned, not only locally, but also with reference to adjoining estates and the requirements of the district generally. Another reason for pressing forward at once with the preparation of town planning schemes is the permanent utility of the work (which has the advantage of practical absence of initial expense), and its possible usefulness in connection with the employment of unskilled labour after the war. It is very satisfactory that the conference of last Spring was not allowed to be regarded as an end in itself, but rather as a means of assisting the Government in defining a definite policy with regard to the important questions raised.

* * *

Motor Vehicles for Municipal Work.

So many local authorities are now considering the question of substituting mechanical traction for horse haulage that the exhaustive report on the subject by Mr. H. Shaw, the engineer to the Ilford Urban District Council, a further instalment of which we publish this week, is of much more than local interest. It is now well recognised that, under favourable conditions, motor vehicles are distinctly more economical for various kinds of municipal work, but it is equally well known that the absence of such conditions will inevitably lead to failure. The most important factor to bear in mind is undoubtedly the necessity for avoiding short journeys and constant stoppages. In dealing with other conditions of successful working, Mr. Shaw pointed out, in the first place, that Ilford has the advantage of good and level road surfaces, while the town also possesses workshops and engineering appliances which afford excellent facilities for quick repairs. Further, in order that the maximum degree of economy may be attained, it is essential that the motors should be kept continually working. Indeed, it may be said that the financial result will be satisfactory in direct proportion to the daily number of hours worked by the motor. It is therefore clearly desirable that all bodies should be interchangeable, so that no time may be wasted by having a chassis unnecessarily idle. Finally, full loads, up to the maker's guaranteed capacity, should always be carried; and the whole machine should be constantly maintained in the highest state of efficiency.

Once it is decided to adopt motor traction for work in any district, it becomes necessary to con-

sider the question of motive power. There are four principal types available, driven respectively by steam, petrol, electricity, and petrol-electricity. Writing a year ago, we pointed out that the choice of motive power must depend on the geographical and economic factors operating in the locality where the vehicle is to work. Where coal is cheap, so far as running costs are concerned, neither petrol nor electric driven vehicles are likely to be so satisfactory or economical as steam-driven vehicles. In a hilly district the petrol-driven vehicle is generally more satisfactory; while the reserve of power which most steam engines have in being able, at a pinch, to give a greater power for a short time than the normal horse-power is in many cases most useful, and is not possessed by either the petrol or electric motor. On the other hand, steam-driven vehicles in urban districts are open to objection on account of the noise and smoke they create. An interesting comparison is made by Mr. Shaw between steel and rubber tyres for heavy steam vehicles. Steel tyres, he observes, are more generally used for heavy steam vehicles travelling up to a speed of about 8 miles per hour, but with a vehicle of lighter tonnage travelling 12 miles per hour and upwards the consensus of opinion is that rubber tyres are a decided advantage. They are much faster, which reduces the running cost, and by the resiliency of the rubber a great saving is effected in the wear of the chassis from vibration, which means much longer life to the vehicle. The noise is also eliminated, and the cost, taking all things into consideration, is very little more than steel. In the body of the report there appears a mass of information gathered from a large number of local authorities having actual experience of the use of motor vehicles for municipal work, and Mr. Shaw has rendered a great service in making this available for general use.

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A Further Advance in Water Treatment.

That tastes and odours due to organic growths in water may sometimes be removed or prevented by the use of copper sulphate is well known. The process is exceedingly simple, and it is probably because of this simplicity, and because good results can be produced by rough methods, that the engineer and the chemist have not troubled themselves greatly as to the improvement of the method. The chemist, having discovered that copper sulphate will get rid of algal growths, has generally contented himself with mixing the copper sulphate with the water in the reservoir by the crude method of towing a bag of the chemical behind a boat rowed across the water in the reservoir. It is evident that perfect admixture and economy of the chemical cannot be effected in this manner; who, for instance, would think of applying hypochlorite in this way? It is clear that the result of such rough treatment must be an overdose of some part of the water and the practical omission of the chemical elsewhere. Although in the end a general mixing may be more or less effected, harm to fish life is probably done in the overdosed sections of the water; also, if the dosing were more equal less chemical would be used, and no part of the water would be so much overdosed as to make it harmful to fish life, while the ultimate general result upon the algæ, and consequently on the water, would be better.

In this relation the work of Prof. N. L. Huff and Mr. G. O. House on the water supply of St. Paul, described in a paper read before the convention of the American Waterworks Association in New York, and dealt with elsewhere in these pages, shows that a distinct advance has been made. Under the conditions existing at St. Paul it was found that a treatment of 1 part of copper sulphate to 10,000,000 parts of water remained effective for five weeks. That such an exceedingly small dose as ·01 parts per 1,000,000 should have been effective at once suggests some difference in the method of application, having regard to the comparatively large doses found to be necessary elsewhere. This work was evidently done very carefully and scientifically. In the first place, it was found that certain quiet, shallow pools were breeding places for various organisms, and by applying small quantities of the chemical at such points the main sources of the trouble were checked. Very shallow bays, flat, muddy shores, and small ponds were treated by spraying the chemical over the water surface with a hand pump. It is to be observed that there the worst places would be inaccessible for a boat, and would therefore receive no treatment. Further, that if a boat were taken through shallow, muddy places, much of the chemical would be absorbed by the organic matter stirred up from the bottom. It is clear, therefore, that the old method of towing a bag of chemical through the water of the reservoir is wrong in principle, for, while the cleanest water is overdosed, the worst places remain untouched. In the old method relatively an enormous quantity of chemical is used, most of it in the wrong place. Further, the conflicting reports as to the harmfulness of this treatment to fish life are explained. It seems surprising, in the light of this discovery, that scientific men and engineers should ever have dealt with a matter of this importance by such very clumsy methods.

* * *

Mr. Duke and Irish Housing Problems.

Mr. Duke, the Chief Secretary for Ireland, has done well to identify himself right away with the subject of housing reform in Ireland. His first public speech to an Irish audience in Ireland was delivered recently upon the opening of Stella garden suburb, Pembroke, near Dublin, consisting of 183 working-class dwellings. Mr. Duke pointed with obvious satisfaction, as he was justified in doing, to the fact that the Pembroke Urban Council, as the result of its comprehensive housing policy, has provided dwellings for 759 families in various parts of the district. This has involved the borrowing of no less than £175,000 by way of loan, and it is claimed that the schemes are established upon a self-supporting basis. If this be so—and Mr. Duke was quite frankly somewhat sceptical on this head—it would appear that the path of the housing reformer is a much more rosy and comfortable one in this part of Ireland than it happens to be in many other places in these islands. It was easy in the face of such a claim to financial stability for the scheme for Mr. Duke to assert that the urban council had made a good investment. If they were losing a substantial sum of money instead of making ends meet, they would have to pay off the loans and cut the loss, but instead they are the owners of a property which is producing £10,000 a year, and the Chief Secretary, with what it is hoped is not undue optimism, sees vistas of wealth which he does not doubt the council will apply to further purposes of betterment in Pembroke.

The remainder of Mr. Duke's speech upon this occasion was devoted to a consideration of the housing question in Dublin. This he described as a problem of as tremendous magnitude probably as any problem which in modern times could engage the attention of statesmen. Briefly, it will call for an expenditure of three and a-half millions for the housing of 31,000 families now occupying not more than one room apiece. He pressed home the responsibility for solving this serious problem upon the citizens of Dublin, and while insisting upon its urgency, he declared that, so far as he might have strength or influence, while he had responsibility in this matter, whether

in a public position or a private citizen, he would contribute his part to the material well being of the Metropolis of Ireland. With respect to the financial aspect of the subject, Mr. Duke exercised the caution that is characteristic of the public official, but it may be accepted as a hopeful sign for the future of Dublin housing that a gentleman occupying his prominent position should have thus promptly recognised its importance as a regenera tive agency, while at the same time proclaiming his eagerness to promote a much desired solution of a notorious evil

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The Rainfall of 1915.

Although the operations of that excellent body the British Rainfall Organisation have necessarily been hampered by the prevailing war conditions, we are glad to observe that it has been found possible to produce the usual annual volume, although in a somewhat modified form. The usefulness of these records, obtained and classified on a uniform scientific basis, to water engineers is obvious, and needs no emphasis on our part. The general result is that the rainfall of 1915 was excessive in three large areas particularly, and over the whole country generally. The general excess in England during 1915 was larger than in any other of the great divisions of the kingdom, being 10 per cent of the average. In Wales there was a general excess of 5 per cent, and for England and Wales taken together the fall was 9 per cent above the average. This excess corresponds roughly to 3·20 in. of general rainfall, or, in other words, England and Wales had during the year 2,700,000 million gallons of rain more than the average fall. In Scotland the large dry areas outweighed the smaller wet areas, and the general deficiency amounted to 8 per cent, while in Ireland there was an excess of 2 per cent. For the British Isles as a whole, in spite of the great excess in the South of England, the general rainfall for the year was only 2 per cent above the average, this corresponding to about ·80 in. of general rainfall. The areas of large excessive rainfall were all in the South and East, and, in vivid contrast with this, the rainfall in the North-west was below and in large areas considerably below the average. The general excess in England and Wales, though not large, is significant when taken in conjunction with the fact that of the seven years 1909-1915 only one, 1911, had a rainfall below the average. So far as we are aware, no similar instance of persistent high rainfall has occurred in England and Wales generally for at least thirty years, and it is clear that the South of Great Britain is at present passing through an exceptional period of wetness, similar to that of the late 'seventies and early 'eighties. In Scotland, on the other hand, only two years in the last eight have been wet, and these not excessively so, and it is thus evident that, whatever may be the cause of the high rainfall in the South, it does not extend to the North of the British Isles. In Ireland the same years have shown a preponderance of small excesses, but for the British Isles as a whole the sequence is confused, the excesses in England having in some years counterbalanced the deficiencies in Scotland and sometimes *vice versa*.

* * *

Part-time Firemen.

The position of part-time firemen with regard to military service was under consideration recently by the West Sussex Appeal Tribunal, when the military representative asked for leave to appeal to the Central Tribunal in respect of certain members of the Worthing Fire Brigade, who had been exempted both by the local and the appeal tribunals. He stated that they were only part-time firemen, paid for their attendance at drills and fires. They were granted three months' exemption on the ground that they were firemen, quite independently of any personal reasons. Exception was taken to these exemptions on the ground that there had been distinct orders that part-time firemen were to be accorded no special privileges by tribunals on account of their service in that capacity. In the particular cases under discussion the exemptions had the approval of the Advisory Committee, and the military representative also regarded them as reasonable. He felt obliged to point out, however, that they were not in a certified occupation, as they were not wholetime firemen, and it could not be said that it was in the national interest they should remain, because they were not habitually employed in the occupation of firemen, being roadmen, &c. The average attendance at fires was only seven a year. He quoted further from the instructions: "With very few exceptions no fireman of military age can be considered indispensable or irreplaceable." The tribunal gave leave to appeal to the Central Tribunal, whose decision will be awaited with interest.

* * *

Afforestation.

Among the many important subjects discussed at the meeting of the British Association recently, not the least important from the national point of view was that of Afforestation, upon which Sir J. Stirling-Maxwell read a paper before the Botanical Section. Sir John is a member of a Government Committee that is inquiring into this question, and, though not putting forward the figure officially, he hinted that our national policy ought to aim at a further 1,500,000 acres being planted, in addition to restoring the existing areas of woodland now being rapidly cut down to meet the exigencies of the war. In the past we have looked at this question entirely from the standpoint of profit and loss. That is entirely wrong. No other country looks at it solely from this point of view. Properly tackled the problem will involve no loss, for afforestation will employ ten men where the same area of grazing would only employ one. While not suggesting that these islands could be made entirely self-supporting and independent of imported timber, Sir John set before his audience the ideal of a self-supporting British Empire. As regards the British Isles, he pointed out that if the total area under afforestation could be increased to 6,000,000 acres, this would at least carry us over a period of five years during a war or any other emergency. In view of the urgency of the question, it is satisfactory to note his remark that this Government is doing more towards finding a solution than all its predecessors put together.

* * *

Selection of Sites for Baths.

A point of some importance to local authorities who may be contemplating the erection of public baths was raised in the paper which Mr. H. W. Harding, chief engineering assistant to the city engineer of Bristol, contributed to last Saturday's Southern District meeting of the Institution of Municipal and County Engineers. The site of the Bristol Corporation's Barton Hill baths was originally a piece of surplus land from a street improvement, supplemented by additional property adjoining, acquired by purchase. This site, though excellently situated in the centre of a large artisan neighbourhood, is, unfortunately, not on a main road, and was of irregular shape and far too small to allow of any liberal treatment in designing the buildings. As Mr. Harding observed, this is a mistake often made, sometimes unavoidably, in the selection of a site in crowded localities, where land is expensive, but a limited area necessarily cripples any plan, however well considered, and the inevitable result is that the several buildings are crowded together with insufficient air space and limited means of intercommunication.

Chlorination of Water.

By CAPTAIN J. RACE, Canadian Army Hydrological Corps.

In The Surveyor of March 3, 1916, page 253, four certain experiments were described which indicated that the germicidal effect of hypochlorite could be considerably enhanced by the addition of an equivalent of ammonia. The difficulties encountered during the translation of the laboratory experiments to the practical working scale were also given, and it was suggested that the loss of available chlorine noted after the admixture of the aqua ammonia and bleach solution could be eliminated by permitting these solutions to mix for only a few seconds before being discharged into the water that it was desired to treat.

The dosing apparatus in the experimental plant referred to (capacity, 200,000 gallons per day) was rearranged and the dilute bleach and ammonia solutions, after passing through the usual controlling apparatus, were brought together in the injection pipe at a point 8 ft. away from the raw water intake pipe. In this way the period of contact, before thorough dilution with the raw water, was reduced to a minimum.

After the adoption of this method of admixture, excellent results were immediately secured, and the dosage was gradually reduced until the purity of the treated water was adversely affected. The dosage was retained at this figure, approximately 0·23 parts per 1,000,000 of available chlorine and 0·12 parts per 1,000,000 of anhydrous ammonia, for a period of several weeks. The results of the daily tests, together with those of the main plant, where 20,000,000 gallons per day were being treated with straight hypochlorite, are given in the following tables:—

necessary in order to prevent complaints. The cost of raising the temperature of the water 20 to 25 deg. Fahr. quickly became a serious financial consideration, and the author was requested to suggest some method of disinfection which would enable the water to be retained for at least seven days. Hypochlorite was first used, but even with doses as high as 3 parts per 1,000,000 of available chlorine, aftergrowths rapidly occurred, and total bacterial counts of 50,000 to 100,000 per c.cm. were repeatedly found; the B. coli index was usually 2 to 5 per c.cm.

Hypochlorite treatment at this dosage was a total failure, and it was deemed undesirable to use larger amounts, on account of the tendency of hypochlorite to cause irritation to mucous membranes.

Chloramine treatment was next used, and after the attendant had become thoroughly conversant with the proper method of application thoroughly satisfactory results were secured. The treatment finally adopted was 1 part per 1,000,000 of chlorine together with 0·5 parts per 1,000,000 of ammonia, and this treatment, when conscientiously carried out, produced a water containing less than 100 bacteria per c.cm. and free from B. coli.

The elimination of aftergrowths by the chloramine treatment is due to the non-absorption of the germicide so that all of the added substances are available for the destruction of bacteria.

It has been suggested that the influence of the ammonia is to increase the oxidising activity of the chlorine, but this view is not supported by the evidence

COMPARISON OF HYPOCHLORITE AND CHLORAMINE TREATMENT.

BACTERIOLOGICAL RESULTS.

1916.	Raw water.			Treated with hypochlorite alone.				Treated with hypochlorite and ammonia.				
	Bacteria per c.cm.		B. coli index per 100 c.cms.	Bacteria per c.cm.		B. coli index per 100 c.c. s.	Available chlorine p.p.m.	Bacteria per c.cm.		B. coli index per 100 c.cms.	Available chlorine p.p.m.	Ammonia p.p.m.
	Agar 1 day at 37° C.	Agar 3 days at 20° C.		Agar 1 day at 37° C.	Agar 3 days at 20° C.			Agar 1 day at 37° C.	Agar 3 days at 20° C.			
March 15—31	44	238	35·7	4	12	0·14	0·90	4	12	0·14	0·22	0·11
April 1—19	3,699	14,408	195·5	32	56	0·50	1·10	33	246	0·74	0·25	0·13

PERCENTAGE REDUCTION.

	Hypochlorite alone.				Hypochlorite and ammonia.			
	Bacteria per c.cm.		B. coli index per 100 c.cms.	Available chlorine p.p.m.	Bacteria per c.cm.		B. coli index per 100 c.cms.	Available chlorine p.p.m.
	Agar 1 day at 37° C.	Agar 3 days at 20° C.			Agar 1 day at 37° C.	Agar 3 days at 20° C.		
March 15—31	90·9	95·8	99·94+	0·90	90·9	95·0	99·7	0·22
April 1—19	98·9	99·6	99·7	1·10	98·3	98·9	99·6	0·25

COST OF MATERIAL PER MILLION IMPERIAL GALLONS.

	Hypochlorite alone.	Hypochlorite and ammonia.
March 15—31	3s. 11d.	1s. 11d.
April 1—19	4s. 10d.	2s. 2½d.

Calculated on bleach at 14s. 7d. per 100 lb. and aqua ammonia (26° B.) at 2·75d. per lb.

These results have demonstrated that the process is eminently practical and can be used to advantage when bleach is abnormally high in price

A further example of the efficiency of this process was found during a series of experiments on the disinfection of the water of a swimming pool at the Ottawa Y.M.C.A. This pool was being extensively used by the various military units stationed in Ottawa in addition to the members of the association, and it was found that frequent changes of water were

available. If the oxidising effect were accelerated, the mixture would be even more readily absorbed by waters containing readily-oxidisable organic matter than hypochlorite alone. Experiments demonstrate the reverse, for it was found that on adding 10 p.p.m. of available chlorine as hypochlorite to the Ottawa River water, about 35 per cent was absorbed in five minutes at 60 deg. Fahr. and 60 per cent within one hour; if an equivalent of ammonia were first added to the solution, only 1·4 per cent of the available

chlorine was absorbed in one hour and 3·2 per cent. in twenty hours.

Again, the oxidising effect of hypochlorite can be measured by its bleaching effect on dyestuffs, and Rideal (*Journal of the Royal Sanitary Institute*, vol. xxxi., No. 2 (1910), p. 40) has shown that the addition of an equivalent of ammonia to hypochlorite solutions reduces the bleaching efficiency to approximately 2 per cent of the original value; these results have been confirmed by the author, and conclusively prove that the enhanced germicidal effect of chloramine is in no way connected with oxidation.

Further studies on substances containing the chloramine group (·NCl) by Dakin *et al.* (*Journal of the Royal Society*, 1916, B. 89, 232-251) would suggest that the usual conception of the germicidal effect of chlorine and hypochlorites being due to oxidation may be erroneous, and that the action should be at least partially attributed to the chloramine derivatives produced by the action of chlorine on amino acids and protein.

BITUMINOUS ROADS IN BRISTOL.

The subjoined particulars of six sections of bituminous road laid at Bristol during the past years were circulated at last Saturday's Southern District meeting of the Institution of Municipal and County Engineers, held in that city. An inspection of the several roads was made by the members in the course of the afternoon.

PRINCE STREET.

This road is subjected to a considerable amount of quay-side traffic, and was originally a macadam road. This form of construction proving very unsatisfactory and costly, in 1905 a twenty-years loan was obtained to pave it with granite setts on 6 in. of Portland cement concrete. Unfortunately, the setts used proved too weak for the traffic to be carried, and after eight years the surface became very uneven. The period of the loan not having expired, any work carried out had to be done out of revenue, and an experiment was made with a bituminous sand carpet, formed of Mexphalte and Bideford sand. The camber on the road being very flat, and the contractors being very doubtful whether a single carpet 1 in. thick would carry the very heavy traffic, it was arranged that a rough coat of ¾ in. limestone aggregate, mixed with sand and Mexphalte, should be laid on the top of the setts, starting from nothing at the channels to 2½ in. in the centre, and a 1 in. carpet of sand and Mexphalte laid on the top over the whole surface. The cost was 5s. per yard, including three years' maintenance, which expires this month, and the result on the whole has been satisfactory. An inclination to waviness has shown itself, and small areas have consequently been relaid, and in the extremely hot weather the material shows a tendency to become rather soft, making traction additionally heavy, probably due to a little excess of bitumen. Before laying the bottom coat the surface of the setts was thoroughly cleaned and the joints opened out as much as possible, and the surface painted over with a solution of bitumen to form a key.

QUEEN'S ROAD.

A 3-in. single coat of bituminous macadam formed of graded limestone from 1 in. to dust mixed with sand and Mexphalte was laid on a concrete foundation in place of wood paving which had been down for fifteen years. This was done to ascertain if there was any advantage in laying bituminous macadam on a concrete foundation. The cost was 5s. 4d. per yard, including three years' maintenance, which terminated last July. This is a motor 'bus route, and the material has stood very well.

PEMBROKE ROAD (TWO SECTIONS).

The first section was laid in 1915, and is a 1 in. carpet laid on the surface of the old macadam road, composed of Bideford sand and Mexphalte, and cost 5s. per yard, without maintenance. The second section was laid in 1912, at a cost of 2s. 6d. per yard, and is a 1-in. carpet laid on the old macadam road and composed of sand, Mexphalte, and a small percentage of crushed granite. This was laid before much experience had been gained in laying these carpet coats on old macadam roads, and a number of small holes were picked in the surface of the road, with a view to forming a key with the surface coat; the road was then painted over with a bituminous solution, and apparently this drained into these holes, with the result that this excess of bitumen has worked through the carpet, and shows a series of patches on the surface. This road, although apparently a residential road, carries a lot of heavy traffic, the gradients being easier to the Downs than the main road, and, as a matter of fact, in 1912 the bulk of the machinery, &c., taken to the Royal Show on the Downs passed along this road.

SUSSEX PLACE.

This is a motor 'bus route, and was laid in 1914. It consists of a carpet of Mexphalte and sand, with about 8 per cent of crushed granite, laid 1½ in. thick on the surface of the old macadam road, at a cost of 5s. per yard, including three years' maintenance. This is one of the most successful lengths of carpet laid in Bristol.

RICHMOND STREET.

Laid down in 1912. This was the first bituminous carpets laid in Bristol, and consists of a layer of Mexphalte and sand, laid on a rough cobble road, and at a cost of 1s. 8d. per yard super., which, of course, did not pay the contractors. The cobble paving was extremely noisy, and, as many railway employees live in this street and have to sleep in the daytime, this was done with a view to making the street quieter. The traffic in this street is light.

EASTON ROAD.

This was a macadam road, subject to heavy traffic, including a motor 'bus route, and was expensive to maintain. In 1915 a 1½-in. carpet of Mexphalte and sand was laid on the surface of the old road, at a cost of 4s. 10d. per yard, including three-year maintenance, and so far has been a pronounced success. A short experimental length of carpet, composed of crushed destructor clinker and Mexphalte, was laid down on the lines of the method introduced by Mr. Lovegrove at Hornsey, and is standing very well.

THE "ROAD PARTY" MAN IN SOUTH AFRICA.

(By a Correspondent.)

The "official" residence of the "road party" man in the up-country districts of South Africa consists of a couple of tents. Near by are the huts of the "boys," and in the intervening space is the Scotch cart. This Scotch cart is the line of demarcation, and in non-working hours no boy is allowed to pass it. If any of the men desire speech of the Baas they take up their position near the cart and await his coming.

The number of boys in a gang depends on the nature and distance of the stretch of roadway each man is responsible for. In some gangs as many as 80 and 100 boys are employed, while others may only total half this number.

The boys are paid ten shillings a month, with a daily allowance of mealies and a monthly allowance of one beast to every forty men. The volume of traffic along these roads is insignificant, but what it lacks in numbers it makes up for in vigilance. Should the post cart be delayed, or a wagon upset, or get stuck for any length of time, the "road party" man on that stretch has to explain why this happened. As a consequence there is often a strained feeling between the man who keeps the road in going order and those who travel over it.

The road man's life is one series of flittings from one part of his district to another, and the Scotch cart and oxen are never left long idle. The first day of arrival at a new pitch is given over to the boys to build their huts and clear the ground round the encampment of long grass. The hours of work are supposed to be ten, but as watches go wrong and the sun has to be substituted as a timekeeper, they are not so strictly kept. In the dry season the life, if monotonous, is a pleasant and healthy one; but in the rainy weather when the water comes down from the hills in rivers and the bed of the roadway sinks, it is far different. It is at this period that the strained relationship between the "road party" man and the post-cart driver and transport rider becomes intense.

Municipal Waterworks Association. — The fifth annual meeting of this body will be held on Friday, October 6th, at the offices of the Metropolitan Water Board, Savoy-court, Strand, London, W.C. The chair will be taken at 2 p.m.

Electric v. Horse Haulage: South Shields Statistics.

The appended statistics of the running costs of an electric motor vehicle with comparative costs as against horse traction have been prepared by Mr. Leslie Roseveare, M.INST.C.E., borough engineer and surveyor of South Shields.

RUNNING COSTS OF TWO-TON ELECTRICAL REFUSE VAN PER WEEK (BASED ON THREE MONTHS' RUNNING).

—	Present rates. 1¼d. per unit as at present.	Present rates. 1d. per unit as proposed.	Pre-war rates. 1¼d. per unit as at present.	Pre-war rates. 1d. per unit as proposed.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Average running hours per week (day shift 50, night shift 41) total per week 91				
Average miles per shift ... ... (say) 14				
Number of shifts per week 12				
Average miles per week ... ... 163·4				
Average current cost per mile at 1¼d. per unit ... ... 3·5d.				
,, ,, ,, ,, 1d. ,, ... 2d				
Average weight carried night and day, 2 ton 6 cwt. = 117 tons per week.				
163·4 miles at 3·5d. per mile	2 7 8	1 8 1	2 7 8	1 8 1
Wages—				
Night driver, £1 11 6 and 3s. 6d. bonus, £1 15 0	£1 11 6			
Day driver, 1 9 6 and 3s. 6d. bonus, 1 13 0	1 9 6			
Washing car on Saturday, two men ¾-day each, 1½ days at 4s. 11d. 0 6 2	0 6 2			
	3 14 2	3 14 2	3 7 2	3 7 2
Maintenance, ¾d. per mile	0 12 6	0 12 6	0 12 6	0 12 6
Oils	0 2 9	0 2 9	0 2 9	0 2 9
Insurance, £10 10s. per annum	0 4 0	0 4 0	0 4 0	0 4 0
Car licence £1, three drivers' licences at 5s. = 15s., total £1 15s. ...	0 0 8	0 0 8	0 0 8	0 0 8
Tyres at 163·4 miles per week, 8,497 miles per annum, £40	0 15 4	0 15 4	0 15 4	0 15 4
Interest and sinking fund	2 7 6	2 7 6	2 7 6	2 7 6
	10 4 7	9 5 0	9 17 7	8 18 0
Add 4 extra fillers on ashpit cleansing work, viz. :—				
2 night fillers, 6 days each, at 5s. 8½d. each £3 8 6				
2 day fillers, 6 days each, at 5s. 8d. each ... 3 8 0				
£6 16 6				
Less ⅛ time not filling 1 14 0				
	5 2 6	5 2 6	5 2 6	5 2 6
	£15 7 1	£14 7 6	£15 0 1	£14 0 6

25 per cent less current will be used when more satisfactory boosting arrangements are provided.

WORKING COSTS OF HORSE AND CART PER WEEK

—			Present rate.	Pre-war rate.
			£ s. d.	£ s. d.
Horse—Night shift 9·16 miles for 6 shifts = 54·96				
Day shift 12·0 miles for 5 shifts = 60·00				
114·96 say 115 miles per week for 2 horses.				
Average working hours per week (day and night) 97				
Horse—Night shift ... 6 loads per shift at 15 cwt. per load ... £4 10 0				
Day shift ... 6 loads per shift at 1 ton per load ... 5 0 0				
£9 10 0 or 57 tons per week.				
	Present.	Pre-war.		
Night drivers, wages £1 11 6 and 3s. 6d. bonus ...	£1 15 0	£1 11 6		
Day drivers, wages 1 8 0 and 3s. 6d. bonus	£1 11 6	1 8 0		
	£1 11 6	£1 8 0	3 6 6	2 19 6
Feeding	£1 0 8	£0 14 8		
Bedding	0 2 0	0 1 6		
Harness (repairs, &c.)	0 0 5¼	0 0 5¼		
Shoeing	0 1 5	0 1 5		
Horsekeeper and stablemen	0 2 3	0 2 3		
New horses to replenish stud	0 2 3½	0 2 3½		
Veterinary charges	0 0 2½	0 0 2½		
Maintenance cost of carts	0 2 1½	0 2 1½		
Maintenance, rates, taxes, lighting and water	0 3 11¼	0 3 11¼		
Interest and redemption of capital costs	0 0 10½	0 0 10½		
	£1 16 2	£1 9 8		
Then 2 horses and their drivers (day and night)			3 12 4	2 19 4
			£6 18 10	£5 18 10

ELECTRIC v. HORSE HAULAGE (*Continued from previous page*).

COMPARISON OF THREE MONTHS' RUNNING COSTS OF ELECTRIC REFUSE VAN WITH WORKING COSTS OF HORSE AND CART.

DATA.—Cost includes drivers, interest and sinking fund, insurance, licences, upkeep, forage, current, and all costs. Horses working from 7 a.m. to 5 p.m. on day shift, and 11 p.m. to 8 a.m. on night shift. Van working 11 p.m. to 5 p.m.

Running costs as transport vehicle without extra fillers, with unit at 1½d. as at present.

	Present rates. Van.	Horse.	Pre-war rates. Van.	Horse
	s. d.	s. d.	s. d.	s. d.
Cost per ton ...	1 9	2 5¼	1 8¼	2 1
,, hour ...	2 3	1 5½	2 2	1 3
,, mile ...	1 3	1 2½	1 2½	1 0½
,, ton mile...	0 11½	1 4½	0 11¼	1 2¼

Running costs for ashpit cleansing work, with four extra fillers (two night and two day), with unit at 1½d. as at present.

	Present rates. Van.	Horse.	Pre-war rates. Van.	Horse
	s. d.	s. d.	s. d.	s. d.
Cost per ton ...	2 7½	2 5¼	2 6¼	2 1
,, ton mile...	1 5½	1 4½	1 5	1 2¼

Running costs as transport vehicle without extra fillers, with unit at 1d., as proposed.

	Present rates. Van.	Horse.	Pre-war rates. Van.	Horse
	s. d.	s. d.	s. d.	s. d.
Cost per ton ...	1 7	2 5¼	1 6¼	2 1
,, hour ...	2 0	1 3½	1 11¹	1 3
,, mile ...	1 1½	1 2½	1 1	1 0½
,, ton mile...	0 10½	1 4½	0 10¼	1 2¼

Running costs for ashpit cleansing work, with four extra fillers (two night and two day), with unit at 1d., as proposed.

	Present rates. Van.	Horse.	Pre-war rates. Van.	Horse
	s. d.	s. d.	s. d.	s. d.
Cost per ton ...	2 5	2 5¼	2 4¼	2 1
,, ton mile...	1 4½	1 4½	1 4	1 2¼

NOTE.—Ton mile estimated on the total mileage for any period multiplied by the average number of tons carried each trip, viz., the average of the loaded and return empty journey.

BRISTOL TRAMWAYS.

PROPOSED MUNICIPAL ACQUISITION.

The negotiations between the Bristol Corporation and the Tramways Company in connection with this proposal being in abeyance consequent upon the war, the committee entrusted with the corporation's interests has taken the opportunity to present a detailed report of the position of the matter, with a statement of the costs incurred in obtaining the further Parliamentary powers deemed necessary, and in obtaining expert advice upon the question as to the advisability or otherwise of the corporation purchasing the tramways.

The costs total £8,068, the principal items being as follow:

Counsel's fees: Sir R. B. Finlay, K.C., £15; Hon. J. D. Fitzgerald, K.C., £458; Mr. G. J. Talbot, K.C., £301; Mr. F. T. Squarey, £239; Mr. E. T. Jones, £201 (Total, £1,217).

Parliamentary agent: £1,020.

Expert witnesses: Sir John Snell, M.I.E.E., £1,198; Mr. C. P. Sparkes, M.I.E.E., £343; Sir M. Fitzmaurice, M.INST.C.E. (retainer), £157; Mr. Andrew Young, F.S.I. (retainer), £105; Mr. J. B. Hamilton, £1,342; Mr. J. M. McElroy, £330. (Total, £3,475.)

Census of tramcar and motor bus traffic: £478.

Printing, advertising, billposting: £86.

Maps and miscellaneous costs: £675.

Poll of city: £869.

The committee point out that the opposition from the Tramway Company and certain ratepayers curtailed approximately about £3,000 of the above total.

Rural Council's War Saving.—Driffield Rural District Council are investing in Exchequer Bonds a sum of £2,500 saving since the outbreak of war owing to their inability to buy road-making materials.

TWO-INCH WOOD BLOCK PAVEMENT.

AN AMERICAN EXPERIMENT.

In October, 1913, a 100-ft. strip of experimental paving was laid in one of the residential streets of Tacoma, Wash., using creosoted wood blocks only 2 in. deep. Inquiry recently by the *Canadian Engineer* brought a reply stating that the pavement is, in general, in good condition. "There has been no heaving. A portion of the pavement which was laid on a concrete base that had a sidewalk finish has apparently separated from the foundation, but this could be prevented in future work. The blocks showed excessive bleeding, but this also could be prevented by different treatment. The street receives very heavy traffic for a residential street, inasmuch as it is the only one used for carting between the two main streets of Tacoma, and it is on the right-hand side leading out of the city, thus getting the traffic of the heavily loaded teams. With the exception of where the joint was made with the asphalt paving, and which slipped up over the blocks, necessitating the cutting away of the asphalt, no expenditure has been made for upkeep on this experimental pavement."

The blocks laid at Tacoma were only 1¼ in. wide by 3¼ in. long. They were Douglas fir, treated with approximately 18 lb. per cubic foot of creosote. On account of the small size, excellent penetration and uniformity of grain were more easily obtained than with blocks of standard size.

The blocks were laid on a concrete base 14½ ft. wide. The pavement was divided into four sections, each 25 ft. long, as follows:—

(1) Blocks laid with long axis at right-angles to the line of traffic, on a 1-in. sand cushion; broken joints, blocks rammed tight.

(2) Blocks laid at an angle of 67½ deg. to line of traffic, on a 1-in. sand cushion; rammed tight and joints broken as in section 1.

(3) Blocks laid on a 1-in. cushion made of 1 part of cement to 3 parts of fine sand, mixed and spread dry; blocks laid with long axis parallel to the kerb, making unbroken joints along the line of traffic; at right-angles to the kerb, joints are broken.

(4) Blocks laid in the same manner as in section 3, excepting that they are bedded in grout of 1 part cement to 3 parts sand, mixed wet enough to take a smooth trowel finish.

"The crushing strength of 2-in. blocks," our contemporary observes, "is said to be approximately as great as the crushing strength of the larger blocks, and as there is not likely to be 2 in. of actual wear during the lifetime of the pavement if the blocks do not rot, break or crack, the 2-in. block would seem to be feasible with proper treatment, provided that they are made so small that the impact of traffic will not break them. The cost of laying the smaller block would, of course, be somewhat higher than the cost of laying the larger block, but this would undoubtedly be far more than offset by the reduced cost of the materials. The further progress of the Tacoma experiment undoubtedly will be watched with interest by municipal engineers."

Waterproofing of Cement Work.—The historic castle of Cape Town, erected by J. Van Riebeeck, the first Governor of South Africa, in the days when the Dutch originally settled in Cape Colony, has been restored. A letter has been forwarded by the Council of the National Society, thanking General Thompson for the very able manner in which the work has been executed. We note from the report that the powder Pudlo was adopted for making the cement work damp-proof and watertight.

Clifton Suspension Bridge Road Levels.—A peculiar feature of the Clifton suspension bridge, mentioned by Mr. L. S. McKenzie, the city engineer of Bristol, in a paper prepared in connection with last Saturday's Southern District Meeting of the Institution of Municipal and County Engineers, is that the road level on the Somersetshire side is 3 ft. lower than that on the Gloucestershire side. It is stated that Brunel was of the opinion that the configuration of the land on each side would have had the effect of causing a level bridge to appear to be out of level, and it was to counteract this effect that the different levels were adopted.

The Use of Motor Vehicles in Municipal Work.

MECHANICAL *v.* HORSE TRACTION.—(2.)

By H. SHAW, M.INST.C.E., Engineer and Surveyor to the Ilford Urban District Council.

[In the following exhaustive report, prepared for the information of the Works Committee of his council, Mr. Shaw presents a mass of valuable facts and figures derived from the experience of various municipalities, and from his own knowledge, as to the advantages and disadvantages of mechanical versus horse traction, and discusses in detail each method of propulsion in order to enable the committee to decide whether the council's work can be carried out to greater advantage by the substitution of horse labour by mechanical traction. The first portion of the report appeared last week.

Edinburgh. This city has an electric lorry, which is used for general purposes. The nett carrying capacity is 30 cwt., and is of the Edison Accumulators, Limited, manufacture. The wheels are wooden, with rubber tyres, and the working cost is as follows:—

Electricity per mile, ·95 units. Lubrication per mile, ·005d. Maintenance, ·52d. per mile. Interest and sinking fund, 5·2d. per mile. Insurance, ·36 per mile.

Essex County Council.—Four 4-ton petrol lorries (McCurd's). Steel bodies, with hand-tipping gear. Steel wheels and rubber tyres. Running cost per ton-mile.

Folkestone. Two 18-50 h.p. petrol vehicles.

"I think I am safe in saying steam rather than petrol for refuse collecting, but petrol rather than steam for fetching and carrying road materials where long distances with good loads can be relied upon instead of, as in refuse collecting, a very small mileage and load with engines running all day."

Glasgow.—Two 30-h.p. petrol hand-tipping (3 tons), several Laffly & Lacre motor sweepers.

"While no economy can be claimed in the case of the refuse removal wagons, the street watering machines on the other hand have proved highly serviceable and more economical than horse haulage. The vehicles are not equipped with interchangeable bodies.

"I may say that my committee has practically decided to introduce two electrically propelled vehicles for the collection and removal of domestic refuse, and I have every reason to believe that for such work electric vehicles will prove their superiority over petrol wagons and be more economical than horse haulage."

Great Yarmouth.—Three to five ton (about 8 h.p.) tipping wagons. (Mann's, Aveling & Porter, Garrett—steam.)

"I have three wagons; Mann's nearly three years, Aveling's and Garrett's two years. I am finding them extremely economical. It is possible by selecting work to reduce cost to half that of horse hire, and, after deducting 12½ per cent per annum for depreciation, my average saving is 33 per cent. I have some long distances which makes this possible."

Hambledon. One 10-h.p., 5 tons, petrol (Dennis), side tipping. Haulage.

Running Costs from July, 1914, to July, 1915.
Mileage, 11,184.

	£	s.	d.
Wages (driver and two mates) ...	220	0	0
Petrol (6 miles per gallon)	116	12	2
Oil and grease	15	19	3
Maintenance on a basis of 20s. per week	52	0	0
Insurance ...	16	0	0
Tyres	73	16	0
Interest	36	0	0
Depreciation (15 per cent on £660)	99	0	0
	£629	7	5

Comparison.

Prices obtained for carting by contract	951	0	6
Cost of running motor ...	629	7	5
Saving	£321	13	1

Hammersmith.—One 32-h.p. (3½ tons) sheet-steel tipping body, interchangeable with cylindrical tipping water-tank body (750 gallons capacity). Used principally for scavenging and watering. (National Steam Car—steam.)

"This has been engaged in collecting house refuse, but cost was greater than when horses were employed. We discontinued using it for this purpose, and now use it for general haulage work. The National Steam Car Company are making an interchangeable water-tank for this motor for street watering purposes, and I am of opinion that this will prove the most economical work on which the motor can be employed."

Haslingden.—Three-ton vehicle; steam. Yorkshire Commercial Motor Co. Used for hauling granite, flags, setts, and general stores. Separate water-tank which can be lowered into body—capacity of 800 gallons, fitted with American sprinklers. Cost complete with water body, £640. The surveyor unable to give running costs owing to shortage of staff.

Kent County Council.—Ten lorries for haulage purposes. (J. & E. Hall, Limited—petrol.)

"In 1910 the county council purchased two lorries, and this number was subsequently increased to ten. For our work we were satisfied that they were a good investment. In pre-war days the average mileage travelled was approximately 13,500 miles per annum, the consumption of petrol varied from 43 to 45 per mile, and the average daily working cost from £1 7s. 7d. to £1 9s. 5d. The cost of these lorries originally was, in round figures, £780. We have not used any interchangeable bodies. Cost of haulage of material per ton per mile is, in the case of lorries, about 6d., and with the horsed vehicles 1s."

Kingston-upon-Thames. — One 5-ton "Overtype" wagon, with interchangeable body—viz., water tank (1,000 gallons) and sprinklers, with Gwynne's centrifugal pump and hose pipe. (Mann's—steam.)

Cost, £560 10s.

Running Cost for 1915 (195 working days) is as follows:—

	£	s.	d.
Coke	33	4	3
Oil	4	2	1
Waste and packing	2	4	2
Insurance	6	18	0
Repairs and renewals	31	16	7
Depreciation (paid out of revenue).			
Driver's wages, 37s. 6d.; assistant, 17s. per week.			

"I consider the corporation have saved 2d. to 3d. per mile by the adoption of a motor in comparison with horsed vehicles. The wagon does the work of three to four horses."

Leeds.—Six of Messrs. T. Green & Sons' motor sweepers in use.

One motor sweeper equals 2½ horses. Running cost per mile, 7·1d. (mileage, 38 per eight hours' shift). Width of brush, 7 ft.

Leicester.—One steam wagon, which is now used for sewer flushing purposes, and was supplied in 1905 by Savage Brothers. It is a 4-ton steam tipping wagon, fitted with interchangeable bodies. Water body holds about 900 gallons. Dry body about 5 cub. yds. Answers its purpose admirably.

One Laffly petrol motor-sweeping machine supplied by W. & F. Archer, Edmonton, London. Working satisfactorily.

Leyton.—The engineer and surveyor reported to his committee in February of this year, and the figures shown in his report were based on information received. The report showed the cost per week over a period of four years (three actual and one estimated) for dust collection (average 20,557 tons) to be £66 4s. 3d. per week. By electric motor vans (2 tons) he estimated the cost per week (capital, maintenance, &c., with a ten-years' loan) to be £60 17s. 4d., and with a four-years' purchase cost £80 6s. 6d. per week. The saving in ten years, with a ten-years' loan, would be £2,780, and with a four years' purchase cost he estimated a loss for the first four years of £2,936, and for the following six years a saving of £6,645, or a nett saving over the ten years of £3,709.

London (City).—Four 3-ton (7 yds. cube) dust wagons, interchangeable with water bodies (700 gallons capacity). (Thornycroft—steam.)

The corporation has ordered six "J" type Thorny-

craft petrol motors in place of above (one only supplied).

"These petrol wagons have a carrying capacity of refuse of 3 tons, and are fitted so as to be utilised either for collection of refuse or for street watering. For the latter purpose they are both efficient and economical, but not quite so economical for the collection of refuse."

Luton.—One 5-6-ton high pressure steam tractor, three trailers. (Aveling & Porter—steam.)

"Purchased in 1910. Tractor cost £405; trailers each £60. Used in connection with the sewage disposal scheme, which involved the carting of some 30,000 cub. yds. of filtering material for a distance of about 2 miles. The tractor was entirely satisfactory, and paid for itself on that one job. Under regular conditions of work I find it costs about 6d. per ton per mile, and is thus much cheaper than horse haulage, when there is regular work for it. Under normal conditions I find that I am able to keep the tractor economically employed during most of the year."

Newcastle.—Machines on order, but not yet delivered. Recommends steamer.

Norwich.—Three wagons; 4, 5 and 6 tons respectively. Tipping bodies interchangeable with watering. (Yorkshire Commercial Motor Company—steam.)

The three wagons are of the standard types manufactured by the Yorkshire Commercial Motor Company. They are used entirely for the carting of macadam, coal, coke, and soil, and in summer alternatively employed for watering suburban roads. When carting macadam, quick loading is ensured by employing an electric crane and grab bucket and quick discharge by tipping. A certain amount of rough spreading is carried out as the wagon travels. Thus the wagons are made to show a satisfactory cost charge on such short haulages.

Great care is taken that, so far as possible, the full tonnage of the wagon is carried at each load.

Running costs during year ended June 25, 1913:

Steam wagon "A" (4 tons), 11 years old	
Miles per load (average)	2·182
Cost per load (average)	8s. 6·315d.
Cost per load per mile	3s. 10·895d.
Cost per ton per mile	11·7d.
(Depreciation at 10 per cent included.)	
Steam wagon "B" (5 tons), 8 years old	
Miles per load (average)	1·963
Cost per load (average)	7s. 7·365d.
Cost per load per mile	3s. 11·34d.
Cost per ton per mile	9·5d.
(Depreciation at 10 per cent included.)	
Steam Wagon "C" (6 tons), 5 years old	
Miles per load (average)	1·3
Cost per load (average)	4s. 2·277d.
Cost per load per mile	3s. 2·67d.
Cost per ton per mile	6·5d.
(Depreciation at 10 per cent included.)	

Each commodore is charged 4s. per hour, which is slightly more than the actual cost of running.

The hiring rate per day for horse in this town was 7s. 3d. per day. In the district, when watering, a van covers about 9½ miles per day, at a cost this year of 12s. 6d. per horse and team. The gallons of water distributed are approximately 7,400. When scavenging one-horse cart and man collects about and tips 3½ loads of sweepings per day, at a cost of 12s. 6d.

Nottingham County Council.—"I have only one steam tipping wagon belonging to this county council. This wagon was purchased in October last, and I am afraid that the short time it has been at work is not sufficient to obtain any definite information as to the cost, &c.

"I may say, however, that the wagon was made by Messrs. C. Burrell & Sons, of Thetford, and supplied along with two trailers at a cost of £800. Up to now the cost of haulage has worked out at 3½d. per ton-mile, as compared with about 10½d. for hired tractors or steam wagons.

"The County Highways Committee are about to purchase another of these tipping wagons from Messrs. Clayton & Shuttleworth, Limited."

Paignton Urban District Council.—One 5-h.p. (5-ton) wagon, tipping body, interchangeable with watering tank. (Foden, steam.)

"Has proved to be a great economy and convenience, especially for long journeys and in street watering."

Pontypridd Urban District Council.—Two 16-h.p. (5-ton) wagons, interchangeable water tanks and wagons for house refuse. (Leyland—steam.)

"These are now about ten years old, and are becoming rather expensive in repairs. I estimate that the cost per ton for collection and haulage works out from between 3s. 3d. to 3s. 6d.

"At present I am obtaining particulars and prices of electrically propelled vehicles to replace my present steamers."

Portsmouth Town Council.—(1) One wagon (Savage steam).

(2) One water tank, fitted with adaptable rollers for use as light road roller (Mann's—steam).

(3) One wagon with interchangeable water tank (Mann's—steam).

(4) One permanent wagon, fitted with solid rubber tyres. Water tank fitted inside body during season (Foden—steam).

All four "guaranteed as to terms of load and speed."

(1) Purchased in 1907, and not altogether successful.

(2) Purchased in 1911, capital cost £602. Quite a practical machine as a roller, and having the advantage of not needing a watering can in attendance, as is usual with a roller.

(3) Purchased in 1913; capital cost £566.

"We have not adopted motor-driven street-sweeping machines. For collecting house refuse it has never been considered that this form of haulage is satisfactory, owing to the constant starting and stopping. For removing large quantities of refuse from barracks, &c., where the van can be loaded up and run direct to the destructor, it is quite satisfactory. With, however, the present shortage of horses and carters, I think it very possible that motor traction will be found to be, after all, a satisfactory means of removing house refuse, even allowing for the drawbacks mentioned. The council has included in this year's estimate a sum for purchasing two other trolleys to be used in this class of work.

"The water-van does the work of at least three horse-drawn vans; it has the added advantage of possessing a larger radius of distribution. We estimate the average annual cost of repairs and renewals as 5 per cent on the initial cost. Drivers are paid 35s. per week, and each is accompanied by an assistant at 15s."

(4) Motor tipping wagon with interchangeable 1,000-gallon water tank, cost £580; but, in order to minimise the noise, it has been fitted with rubber tyres at an extra cost of £85. It is hoped that the rubber tyres will reduce the expense of upkeep, as the machinery should not be so much shaken.

Richmond.—Three steam wagons. Tare weight of container—two, 4 tons 19 cwt.; one, 3 tons. Capacity of water vans—two tanks, 900 gallons; one, 600 gallons. Cost—two, £600 each; one, £575, including interchangeable tank. Artillery tyre wheels with steel tyres; one plain, two with strakes. Total cost per day 18s., exclusive of repayment of loan and interest.

Rochdale.—One 3½-ton (melt) wagon (Clayton & Co.—petrol.)

"It cost £700, and was put to work in an added area, instead of adding four horses, stables and vehicles. It has done well, and been in use five years, and we are now considering the matter of a further mechanical vehicle. It has been used in the collection of ashes, &c., in connection with this department."

Rochester.—"We use steam tractors here for a particular purpose—viz., the haulage of vacuum sanitary tanks for the removal of the liquid contents of cesspools, but we do not use motor vehicles for general purposes.

"I am sorry I can give you no particulars of the cost as compared with horse tractors. My staff is not sufficient to admit of my keeping the details necessary to make a fair comparison, but you may take it that the advantage is in favour of the steam tractor."

St. Marylebone.—Last year this borough council purchased two Laffly petrol motor sweeping-machines (F. C. Archer). Cost, about £650 each. Third similar motor sweeper on order from same firm. No detailed statistics available as to the cost per mile. Machines have carried out their work (chiefly night cleansing) satisfactorily and efficiently.

Sheffield.—A report issued by the responsible officer to this corporation shows that cost per ton of collection of refuse by day by a 2-ton electric vehicle over a twenty-two weeks' test was 5s. 0·8d. Horse

work on same district for one month cost per ton 7s. 0·4d.

Night work for twenty-one weeks' test by electric vehicle cost per ton 2s. 3·4d. For three months' test by horse work, cost per ton 3s. 3·2d.

A test of a second 2-ton electric vehicle worked by day on refuse collecting over a period of six weeks came out at 4s. 0·1d. per ton. Horse labour collecting in the same district over a one-month period worked out at 3s. 8·6d. Night work for a six weeks' test by the electric vehicle cost 1s. 10·3d. per ton, while collecting by horse labour for a one-month test on night work cost 2s. 6·2d. per ton.

The report states that horse labour holds an advantage where the total mileage per journey does not exceed three, but over this distance the electric vehicles show a decided superiority. With electric only used on day work position differs somewhat, as the vehicle costs cannot be divided over two shifts. With night and day shifts by same machines it is a pronounced success.

Six 5-ton lorries, which were taken over by the War Office in August, 1914, the cost of which was £4,350

The average running cost per mile was 8·82d. Average cost per mile, including depreciation, was 1s. 0·05d. Average cost per ton per mile was 5·55d.

Estimated saving over horses during the whole period of working is £3,003.

The motors were installed as follows: December 15, 1910; May 14, 1912; July 31, 1913 (two); June 10, 1914 (two).

Also two electric tipping wagons, 6 cub. yds. capacity, 2-ton load. Cost £1,000. Made by Edison Accumulators, Limited. Rubber tyres. Electricity cost 1¼d. per mile, negligible.

Southend.—1,000-gallon steam vehicle for street watering. Total cost per day, £1 9s. 1d.; twelve loads per day, 12,000 gallons; average mileage, 26. Cost per mile, 13s. 6d.

Six hundred and thirty-gallon petrol vehicle. Total cost per day, £1 18s. 1d.; fourteen loads per day, 8,400 gallons; average mileage, 38. Cost per mile, 1s.

Note.—The time taken for filling the van in this town is more than it should be.

South Shields.—2-ton tipping wagon. (Edison—electric.)

"We have had the van in use for about three months, which is, however, rather a short time to give detailed figures, although the statistics for the same are being taken out. This van cost practically £1,000, and has a normal capacity of 2 tons, but it can carry more, and is used mainly for the collection of privy ashpit refuse, for which, having regard to the ease of starting and stopping and silent running, it is eminently suitable. The van is at work from 11 a.m. to 5 p.m., being charged up between 5 p.m. and 11 p.m., and while engaged on this work is equal to three horses on night and three horses on day shift. The current consumed out of battery works out at about 2 ampère-hours per ton-mile."

Southwark.—Steam motor wagon on order from Yorkshire Commercial Motor Company. Cost £640. Being specially built as a dust van with low sides and mechanical tipping gear; carrying capacity of 3 tons.

Stockport.—Steam motor wagon used by gas department for conveying coal and coke. Yorkshire Motor Company's manufacture. Capacity 6 tons, on wagon body. No running costs given owing to the short journeys performed by the motor.

Surrey County Council.—"For my purpose, which requires long journeys, 5-ton petrol motors are the most convenient. The cost works out at about 4d. per ton-mile of material carried, including costs and 20 per cent depreciation on the vehicles."

Tunbridge Wells Town Council.—Two 30-h.p. (6 cub. yds.) tractors, with detachable trailer wagons (two each) for haulage of stone, pipe and other materials. Tractors convertible to light road rollers if required. (Aveling & Porter—steam.)

"Cost of tractor, purchased two years ago, was £550. Each of the tractors easily does the work of five horses—horse contractors in this town are now asking 12s. to 13s. per day per horse, cart, and man. I have not kept any separate detailed account of running these tractors for haulage purposes as they are convertible into light rollers when required."

Walthamstow Urban District Council.—Two 25-h.p. (5-ton) interchangeable wagons (tipping) and street-watering machines. (One Mann's, one Clayton—steam.)

One 20-h.p. (4-ton) tipping-box, convertible to road roller (6 ton), and street-watering machine. (Mann's—steam.)

One 15-h.p. (3-ton) tipping wagon (not convertible). (Mann's—steam.)

Wagons used for carriage of small quantities of materials for repair jobs.

"I am very well satisfied with the results of my experience. As regards street cleansing, refuse and slop collection, and the carriage of water for road making, I am not at the moment satisfied that motor vehicles can be economically employed on either of these works.

"I have had a Lafflly in use for some time, and am exceedingly pleased with it."

Warminster Urban District Council.—One 6-ton wagon. (Alley & Maclellan—steam.)

"As conditions are not normal, owing to large military camp in the district, the comparison between the cost of mechanical and horse haulage would not be of much value. Without the steam wagon I could not possibly have carried out the repairs to the roads, as there is a scarcity of horses and the rate for hire very

—	—	—	Cost of motor traction.	Cost of horse working.
Anglo-American Oil Company	Steam	Haulage	5·78d. per mile	
Anglo-Mexican Oil Company	,,	,,	1s. 2d. per mile	
Bedfordshire C.C.	Petrol	,,	3·95d. per ton mile	
Birmingham	Steam	,,	9d. per mile approx.	
Bradford	Petrol	Permanent-way work	7·8d. per ton mile	
Bristol	Steam	Haulage	Charged to works at 25s. per day	
Burton-upon-Trent	Steamer	Clinker conveying	6d. per ton mile	1s. per ton mile
Chelsea	Steam	Refuse collection	4s. 6d. per ton	4s. 9½d. per ton
Deptford	Petrol	Sweeper	6s. 2·8d. per mile	10s. 5·7d per ton.
Ealing	Steamer	Watering haulage	£1 per day	
Hambledon	Petrol	,,	£629 7s. 5d.	£951 0s. 6d.
Kent C.C.	,,	,,	6d. per ton mile	1s. per ton mile
Kingston-upon-Thames	Steamer	Watering	2d. to 3d. saving ov	per mile er horses
Leeds	Motor	Sweeper	7·1d. per mile	
Luton	Steam tractor	Haulage	4d. per ton mile	
Norwich	Steam	,,	11·7d. per ton mile (4 tons), 9s. 5d. per ton mile (5 tons), 6s. 5d. per ton mile (6 tons)	
Nottingham	,,	,,	3½d. per ton mile	
Richmond	,,	—	18s. per day exclusive of loan and interest	
Sheffield	Electric	Refuse collection	5s. 0·8d. per ton by day, 2s. 3·4d. per ton by night, 4s. 0·1d. per ton by day, 1s. 10·3d. per ton by night	7s. 0·4d. per ton by day, 3s. 3·2d. per ton by night, 3s. 8·6d. per ton by day, 2s. 6·2d. per ton by night
	Motor lorries	General	5·55d. per ton mile	
Southend	Steam	Watering 1,000 galls. van, 630 galls. van	£1 9s. 1d. per day, 1s. 1·6d. per mile, £1 18s. 1d. per day, 1s. per mile	
Surrey C.C.	Petrol	Haulage	4d. per ton mile	

high—practically double pre-war prices. Our wagon is an old "Sentinel" purchased for about £200. It has been running twelve months, and has given great satisfaction. There is no doubt about the advantage of these vehicles over horses, and when times become normal I shall recommend my council to purchase an up-to-date motor vehicle with interchangeable bodies."

Bucks County District Council. One 10-ton (3-ton) wagon (interchangeable with water tank (600 gallons capacity). Used for road rolling, hauling, and street watering purposes. (Mann's steam.)

"The actual cost is 1s. 6d. per day, and it does the work of four horses."

RUNNING COSTS.

You will notice there is considerable variation in the running costs as recorded in the foregoing statements, and I append here, for your better information, a short summary of the statements:—

The differences in figures may be caused by many reasons. Running costs, for instance, is a term which may be answered in a variety of ways. Then there are the load factors (over-loading and under-loading) local and traffic conditions, wear and tear and repair items, amount of time in which the machines are standing idle or working, &c.

In order that you may have all available up-to-date information at your disposal I quote other figures which have been compiled by an expert on mechanical traction, after full consideration being given to all makes of vehicles and varied conditions.

The table, therefore, may be taken as a very fair guide in regard to running costs, and considered with the statements of other municipal authorities, and their explanatory notes and the manufacturers' estimates, a reasonable conclusion can be arrived at.

I may here note that no standard statistics to my knowledge have been compiled and published with reference to electric or petrol-electric vehicles; therefore those issued by the manufacturer must suffice in the latter case, while in the former case I have taken your council's electricity department's working cost for purpose of my comparative estimates.

Estimate of Running Costs for Petrol and Steam Vehicles of Three Tons Nett Load.

Petrol motor. Life of vehicle taken as 50,000 miles. Basis cost £740, exclusive of body. Average mileage per day, 40.

	s.	d.
Interest on capital 5 per cent.	2	0
Depreciation	3	10
Insurance	1	0
Garaging	0	6
Tyres	8	8
Driver's wages	6	0
Oil	0	8
Petrol (7 miles per gallon at 1s. 6d.)	8	6
Repairs	2	0
Per day	33	2

or 9·9d. per mile.

Steam vehicle. Life of vehicle taken as 50,000 miles. Basis cost £575, exclusive of body. Average mileage per day, 40.

	s.	d.
Interest on capital 5 per cent.	1	6
Depreciation	2	10
Insurance	1	0
Garaging ...	0	6
Tyres	10	0
Driver's wages	6	0
Stoker	4	0
Oil	1	1
Coal (15 miles per cwt. at 1s. 3d.)	4	0
Repairs	3	0
Per day ...	33	11

or 10·06d. per mile.

Electric vehicle. Cost of vehicle, £1,240. Cost for week ending May 24, 1916.

	£	s.	d.
Wages	4	0	0
Current	0	14	0
Sundries	0	2	0
Tyres	0	8	0
Capital charges and insurance	3	1	0
Per week of 5 days	£8	5	0

27s. 6d. per day = 9·3d. per ton per 1½ miles.

The electrical engineer informs me that the "all-in" cost of the electrical vehicle under his control works out at about 9·56d. per ton. The journey being about ¾ mile each way, the cost per ton-mile therefore becomes about 6·13d. per ton-mile.

Petrol-electric Vehicles. I have no details to submit as in the case of steam or petrol vehicles, but have an "all-in" mileage rate of 9·25d. and a daily cost of 30s. 10d.

Having given you all the information obtained from other municipalities as to their experience, I will now deal with the financial side as it will affect this council, and give my opinion as to the comparative working costs of horse labour and mechanical traction.

For the purpose of my calculations I have taken as my bases for petrol and steam and electric vehicles the figures as shown in detail.

For the petrol-electric vehicle I have taken the running cost as above as given by T. Tilling, Limited, who work motor lorries, mail vans, &c., with this type of vehicle.

For calculations of horse labour I have taken the figures of the accepted tenderer for the current year's contracts.

The contract prices for this year are higher than they have previously ever been to my knowledge, and it is hoped prices for horse labour will decline considerably when the present hostilities are ended. Against this the prices of fuel, oil and tyres of motor vehicles will also decrease, so that the ruling prices of the present time can be taken as fair comparisons.

Haulage Work. Day-work Prices.

Journeys between 1 and 2 miles, one way.

Horse labour, 12s. Average five journeys, with a load of about 30 cwt. each journey. Total material, 7½ tons.

Petrol, steam, electric or petrol-electric vehicles can all average ten journeys with a load of about 3 tons each journey. Total material hauled 30 tons.

At daily costs of petrol ...	33'2		
steam ...	33'11		
electric ...	33'0	6'1	per ton mile.
petrol-electric	30'10	(40 tons).	

Result, day work rate:—

	s.	d.	
Horse labour ...	1	7·2	per ton.
Petrol vehicle ...	1	1·2	,,
Steam vehicle	1	1·5	,,
Electric vehicle ...	1	0·2	,,
Petrol-electric		9·2	,,

Piece-work.

Journeys average 2 miles cartage.

Horse labour, 1s. 4d. per ton.

Result, piece-work rate:—

	s.	d.		d.	
Horse labour ...	1	4·5	per ton, or	8·2	per ton mile.
Petrol vehicle ...	1	1·2	,,	6·6	,,
Steam vehicle ...	1	1·5	,,	6·7	,,
Electric vehicle	1	0·2	,,	6·1	,,
Petrol-electric		9·2	,,	1·6	,,

NOTE. I might mention that in a paper which was read lately by a responsible official of the Sheffield Corporation the statement was made that "an advantage of motor transport, as compared with horse haulage, was that the motors would serve a radius of 30 or 40 miles per day, as compared with 12 miles for horse haulage."

It is also necessary to mention that in calculating rates of the motor vehicles I have allowed the same cost for 2-mile journey as 1½ miles or 1¼ miles, and for a 3-tons load, whereas some of the 3-ton vehicles carry between 3 and 3 tons 17 cwt.

In order to explain more fully the meaning of the first part of this statement, it seems advisable to point out that when on piece work, as soon as a horse-vehicle has gone over 1 mile, the 2-mile rate is paid.

The same rate per mile has also been allowed for returning empty, to fill up, as when full, also the extra distance rate.

You will therefore see that, although a saving will be made of practically 3d. to 3½d. per ton in the cost of petrol or steam vehicles, and 4½d. per ton by an electric vehicle, and 7½d. per ton by petrol-electric vehicle, it would rarely work out in practice at more than this.

(To be concluded.)

Institution of Municipal and County Engineers.

SOUTHERN DISTRICT MEETING AT BRISTOL.

A successful and highly interesting meeting of the Southern District of the Institution of Municipal and County Engineers was held at Bristol on Saturday last. Mr. J. S. Pickering (Cheltenham) the district chairman, presided, and there were present the Lord Mayor of Bristol (Dr. Barclay Baron), the Sheriff of Bristol (Mr. H. E. Chattock), Messrs. Charles T. Enwright (Bristol), J. G. Powell (Wilts County), R. B. Lees (Bradford-on-Avon), R. C. Stephens (Bristol), C. H. Sunderland (Midsomer Norton), W. J. Goodwin (Salisbury), T. Caink (Worcester), J. Parker (Hereford), E. W. A. Carter (Gloucester), N. F. Spence (Marlborough), H. J. Farmer (Christchurch), W. H. G. Keiser (Bristol), F. Dolamore (Bournemouth), H. C. Phillips (Mere), E. S. Perrott (Bristol), J. C. Hunt (Bristol), H. H. Howell (Bristol), F. H. Smith (Portishead), A. H. Claypole (Bristol), H. W. Harding (Bristol), F. J. Williams (Bristol), F. R. Phipps (Basingstoke), L. S. McKenzie (Bristol), T. H. Yabbicom (Bristol), G. Stephens (Bristol), and H. Howard Humphreys (Westminster).

The members were received at the Council House by the Lord Mayor, who said it gave him great pleasure to welcome them. After referring to previous visits of the institution to Bristol, his lordship went on to comment on the fact that out of a total membership of some 1,800, over 200 members were engaged in war work. That was very satisfactory, and showed their patriotism, but at the same time must have meant a considerable amount of embarrassment in their work. But one was naturally delighted to know that men from every direction had come forward to fight for the Empire. The Southern District, he understood, was a wide and important area, stretching as far as the Isle of Wight, and included ninety-five members. It gave him pleasure to be present with them that day—for two reasons. One was that it enabled him to welcome their very much esteemed friend Mr. Yabbicom, their former city engineer; the other was that he was able to say publicly—what every member of the corporation would cordially endorse—how very highly they appreciated the services of the present city engineer, Mr. McKenzie. He desired at the same time to bear testimony to the important work that was being done by their institution. As a member of the medical profession, he knew that preventive medicine was often more important than curative medicine, and the whole business of their life consisted of preventing disease by providing for the cleanliness of streets, efficient sewerage arrangements, attention to water supply, and various other things. They were all working in the same direction and were largely responsible for the prevention of disease, and therefore it was very difficult to overestimate the value of the work done by a large number of trained specialists in sanitary engineering, such as they were.

Mr. Yabbicom said the first time he had the pleasure of meeting the institution at Bristol was in 1878. At that time his respected predecessor, Mr. Ashmead, occupied the position of president, and it was stated with much pride in the annual report that the roll of the association was nearly 200. They had grown since then, and to something like maturity. The next time the institution visited Bristol was in 1896. At that time Mr. Ashmead had retired from his more active duties, and he (the speaker) filled the position of city engineer. That year, Mr. May, of Brighton, was their president. The third occasion was the annual meeting in 1902, when the institution did him the honour of making him their president. It was a successful meeting, and many papers were brought forward, and, what was more remarkable, they were all discussed. This was the fourth visit, and he was glad to see that the membership was now 1,800. Their members were scattered all over the world. Of course, the greater number were in the British Isles, but they had twenty in India, thirty-five in the South African district, and in various other parts fifty-one. Of their members on active service he was sorry to say many had been wounded, and there were some whose names would be inscribed on the roll of honour in the future.

The Sheriff of Bristol said that as an engineer he would also like to say a few words. He had long since given up practice, but he still took great interest in engineering matters, and was proud to think that since the war commenced a great part of the victories was due to the work of the engineers.

Mr. Pickering, in returning thanks, observed that the visit which the institution paid to Bristol thirty-nine years ago formed an interesting record in their proceedings, particularly on account of what might be termed an historical discussion on the vexed question of the ventilation of sewers—a problem which even now had not been properly solved. The institution's volume of proceedings contained, he thought, particulars of most of the municipal undertakings of Bristol, but many of the members had not had an opportunity of seeing these works, and he felt sure from the excellent programme that had been arranged that day that their visit would prove both interesting and profitable. It seemed specially fitting at a time like the present that they should meet together to see if they could not effect an improvement in their methods of working under the special circumstances that prevailed. Those of them beyond the fighting age who were left behind to attend to their various duties under the public authorities they served felt it was most beneficial to attend meetings of that description to gather information which might be of the utmost value to the communities they represented. Now that economy had to be practised in a far more drastic manner than was ever dreamt of, it was very necessary that as municipal engineers they should lose no opportunity of making such improvements in their practice as would result in more economical methods. Manufacturers, too, would require to take steps to reduce the cost of the articles which they produced.

DISTRICT COMMITTEE.

Following upon the confirmation of the minutes of the previous meeting—held at Salisbury on May 16, 1914—the Executive Committee for the district was re-elected as follows: Messrs. S. Stallard (Oxford), J. S. Pickering (Cheltenham), W. J. Goodwin (Salisbury), S. J. L. Vincent (Newbury), J. A. Crowther (Southampton), L. A. Cozens (Isle of Wight), J. W. Webster (Cowes), T. J. Guilbert (Guernsey), and J. H. Blizard (Southampton).

On the motion of the chairman a vote of thanks was accorded to Mr. R. Read (Gloucester) for his past services as chairman of the district.

SURVEYORS AND PETROL.

A member put a question as to whether the institution had taken up the question of the supply of petrol for engineers' and surveyors' motor-cars.

The Chairman answered in the affirmative. The council had done what they could, but the Government did not seem to think surveyors should have special treatment in the matter. It had been pointed out to the Petrol Control Committee that the work of the municipal engineer was quite as important as that of the doctor, who got his supply of petrol without difficulty. It was now for individual members to worry the Control Committee, and the more complaints the better.

A speaker expressed the opinion that, in view of the importance of the matter it should be taken up at the first meeting of the council and another application made.

PAPERS AND DISCUSSIONS.

Papers dealing with the Clifton Suspension Bridge, the Eastville refuse destructor—an illustrated description of which appeared in last week's Surveyor—Barton Hill Baths, and six sections of bituminous roads laid during the past four years in and around Bristol, were submitted by Messrs. L. S. McKenzie, Assoc.M.Inst.C.E., the city engineer; A. H. Claypole, Assoc.M.Inst.C.E., and H. W. Harding. Extracts from these contributions are given elsewhere in this issue.

CLIFTON SUSPENSION BRIDGE.

Mr. Howard Humphreys, consulting engineer to the Bridge Company, said that he agreed with the whole of Mr. McKenzie's paper with the exception of a little bit of the chronology. The first stone was laid by the Marquess of Northampton in 1836, on the occasion of the visit of the British Association. In 1843 the whole of the funds had been expended, and still much remained to be done. In 1853 the work was closed down. In 1859 Mr. Brunel died, but he had spared no effort in the meantime to get the

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bridge completed. Mr. Baumel always looked upon the bridge with great interest, because it was the starting-point of his career. He suggested that Bristol should erect some kind of memorial to him, seeing how closely he was identified with the city, and how much Bristol owed to him.

Asked as to whether the substitution of Limmer asphalt for the floor of the bridge roadway in place of Memel timber had proved satisfactory, Mr. Humphries said it had been as satisfactory as one could expect in view of the severe undulations and disturbance that was constantly going on. The company had found it about the best kind of flooring procurable. The ideal material would be vulcanised rubber, but the cost of that, of course, would have been colossal.

EASTVILLE REFUSE DESTRUCTOR.

On the presentation of Mr. Claypole's paper, Mr. F. DOLAMORE asked whether the fires were banked up during the periods the destructor was shut down, and whether when the fires were allowed to go so low it was not destructive to the furnace lining.

Mr. CLAYPOLE said the fires were banked up while the destructor was shut down. It was not, of course, good for the furnace lining, but it seemed to have done very little harm, and as the tips filled up they would be able to keep the destructor going throughout the whole twenty-four hours.

Mr. J. PARKER inquired whether there was more than one destructor. In Hereford they had one which had been in operation for more than nineteen years, but it consumed only a little more than half the refuse he had to deal with. The rest caused a nuisance wherever they tipped it, and they were now face to face with a second installation, in connection with which it was intended to utilise the heat for the swimming baths. The scheme, however, had been shelved for the present. It seemed to him that in a place like Bristol there ought to be more than one destructor. During the time his own destructor had been at work he had not used a hatful of coal, and it had paid for itself three years after coming into operation. They had not changed the fire bars once during the whole of the nineteen years, and it was remarkable how small the cost of upkeep had been in other respects. He was a believer in destructors, and but for the war Hereford would have been in possession of another installation by now.

The CHAIRMAN asked whether trade refuse was removed by the corporation free of charge. The site of the destructor was a difficult one, and he should like to know what was the average depth to which the piles were driven through the 30-ft. bed of clay. Jarrah wood, he noticed, had been used for the approach road, but having regard to the corrugations which took place in that kind of wood, that did not appear to him to be the most suitable material to adopt in a position where horses were continually turning in and out. Were the destructor units worked alternately or together? He gathered from the paper they were worked together, but if that were so he would like to know when the flues were cleaned out. He was particularly interested in the use to which the clinker was put, and he was glad to see some trials in bituminous road construction were going to be made with it. There was a great future in that, because it would be one of their duties now to find means of making such roads at a greatly reduced cost; and where the traffic was not great he thought the bituminous clinker road would prove satisfactory. What was the electrical energy used for? The paper merely said the destructor power was used for generating electric energy, and possibly it might only be employed for lighting the works, running the crushing machine, and so on. That was an interesting point, for with something like 110 tons of refuse being burnt daily, and with coal at £1 per ton, the steam produced must be worth £2,000 or £3,000 per annum. As regarded the sorting out of paper from the refuse, his view was that it would be far better if that were collected separately from the houses. Mr Pickering added that he would like to have the cost of burning.

Mr. CLAYPOLE, replying, said there was another destructor. The approximate total quantity of refuse collected per annum was about 95,000 tons, and previous to the erection of the destructor about 60,000 was tipped. As regarded fire bars, the destructor had not, of course, had a great life yet, and they only started full firing in November, 1914. A charge was made for the removal of trade refuse. The construction of the ferro-concrete raft was naturally the most important feature of the undertaking. The site was an excellent one as regarded position, but a bad one as regarded foundations. The piles were driven down to the marl. As to the question of corrugation, there were no corrugations at present. The units were worked together. The flues were cleaned out on Monday mornings, the men coming a little earlier than usual to do the work. The flue dust was sold for the manufacture of disinfecting powder.

The CHAIRMAN: Does the cleaning take only one morning?

Mr. CLAYPOLE: Yes; from 5 to 10 o'clock. The combustion chamber was cleaned out less frequently. The electric energy was used at present just for driving the mortar mill and the clinker crusher, lighting up the place, driving the fan for forced draught, and pumping water from the river for purification and softening purposes. There was, of course, a great deal of steam going to waste. A large quantity of the clinker had been used for camp roads, but during the first year both the clinker and ash were tipped on the site to fill up holes. As to the sorting of paper, a certain amount was always to be found in the refuse, apart from that collected separately. The boy engaged on the sorting more than paid his wages. Owing to the war they were naturally working under exceptional conditions, but the cost of destruction came out at about 2s. per ton.

BARTON HILL BATHS.

A few questions were put to the author of the baths paper, Mr. Harding, who in the course of his reply stated that they had no means of regulating the supply of hot water to the spray or needle baths, but any excessive use would be pointed out by the attendant. There had been no complaints as to the Terrazzo paving being slippery, but in their new baths they had adopted Ruabon ribbed tiles. The plant was capable of maintaining the water in the baths at a temperature of 75 deg. under normal conditions; but in the past twelve months they had reduced the figure, and they had, he believed, got down as low as 68 deg. As to whether the water was cleansed after heating before being returned to the bath, a filter was provided, but there was no system of water softening.

In the course of the afternoon an inspection was made of the works described in the several papers.

Maidstone's Municipal Farming.—Maidstone Corporation has been experimenting in municipal farming, and a potato patch of a little under 4 acres at the sewage disposal works has shown a profit of £160.

Water Disinfection.*

By R. B. MORSE, Chief Engineer, and H. R. HALL, Assistant Chief Engineer, Maryland State Department of Health.

There are eighty-three public water supplies in Maryland, serving about 842,500 people 62·1 per cent. of the estimated total population of 1,357,374

Broad as is the control of the State over the design and construction of water supplies, it is no more liberal than is its authority over the operation of existing systems, in so far as the public health is affected. If the State Board of Health finds that any water plant is not properly operated, it may require a change of method, and may, when necessary, force the employment of competent attendants, if even being enabled to attain this end by appointing attendants of its own selection at the cost of the municipality or water company owning the plant. Possible arbitrary action, however, is precluded by a provision in the law allowing appeal to the local county court, before which the board would have to prove the reasonableness of its act.

The State's investigations commenced to show that many of the water systems were badly in need of attention. The surface supplies were derived from streams fed by watersheds containing habitations, in many cases providing numerous sources of contamination, and, in general, protection was not offered by long storage, filtration, or other treatment. Water was usually taken from the stream at an intake dam, and passed into a distributing reservoir of insufficient capacity to provide a safe period of storage. Moreover, water from some of the tubular well systems was found to be polluted, because the wells either were of too shallow depth and located in the midst of thickly-settled districts, where sources of pollution were numerous, or were driven in rock containing fissures. Some supplies previously considered to be beyond suspicion were found upon close investigation to be in a bad condition, and a menace to the public health.

In a large number of the instances where supplies were polluted the water was satisfactory from a physical standpoint, there being an absence of colour, turbidity, and other objectionable characteristics. This was naturally true in the case of most well and spring waters. The water from streams fed by mountain watersheds, and from watersheds containing much wooded or uncultivated land, was also generally in good physical condition.

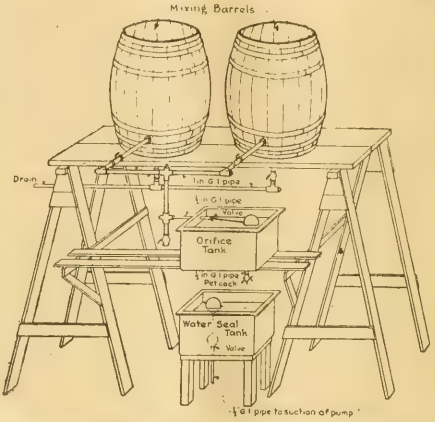
Where water, otherwise acceptable, was found to be in an unsafe sanitary condition, filtration did not appear to be necessary or even advisable for assuring the proper degree of purity. Expense and the improbability of proper operation are two factors which would make filtration plants undesirable for many of the small systems which abound in Maryland. Consequently, disinfection was resorted to wherever it would serve the purpose. There were, however, a considerable number of surface supplies derived from streams flowing through cultivated country and furnishing a water occasionally or persistently turbid. Such supplies as these naturally require filtration. Disinfection in connection with filtration is general, and is required in all new installations. While the writers' assistants have been able to obtain good results from several filter plants without the addition of disinfectants, the character of attention which small works ordinarily receive makes their use essential.

METHODS.

Disinfection by means of hypochlorite of calcium or liquid chlorine is naturally the most common method practised, although one small mill town uses distilled water, which is the condensed exhaust from the steam turbines in the mill, and there is an ozone plant which is operated in conjunction with one of the hypochlorite installations. There is a possibility that ultra-violet ray disinfection will shortly be introduced, as its use is under consideration for a mechanical filter plant now being constructed

The type of apparatus suitable for hypochlorite or liquid chlorine treatment in any particular case depends upon the method by which water is supplied. Where the flow of water to be treated is at most times substantially uniform, as in the case of certain pumping plants, or in gravity lines discharging into reservoirs, a manually-controlled apparatus is sufficient. Where fluctuations occur in the rate of flow, automatic control devices are essential for proper results. Liquid chlorine plants, so-called, introduce chlorine into the water, either as a gas or in solution. The gas feed, usually called "direct feed," is well adapted for use where no water under pressure, for dissolving the gas, can be easily obtained.

The amount of chemical used at the disinfecting plants in Maryland has varied widely according to local conditions. It has ranged from 0·2 to 3·0 parts per 1,000,000 of available chlorine in the case of hypochlorite treatment, and from 0·25 to 0·67 parts where liquid chlorine is used. Where the disinfectant is applied to a spring or well water, or to the effluent from a well-operated filtration plant, the amount required is usually near the minimum mentioned above. In the case of turbid waters, larger amounts have been found necessary for proper treatment, and



Emergency Hypochlorite Plant for Disinfecting Water Supplies.

List of Material.

Two clean watertight barrels.
Several feet of 1-in. and ½-in. galvanised iron pipe and tools for cutting and threading.
Five 1-in. valves.
Four 1-in. "T" branches.
One 1-in. by ½ in. cross or 4-way fitting.
Four locknuts to attach 1-in. pipe to barrels.
One 1-in. cross or 4-way fitting.
Four 1-in. pipe plugs.
One ½-in. pipe plug.
One ½-in. pet cock.
One watertight tank, preferably lead lined, with valve, and float control which opens valve as water level drops. An apparatus of this type easily obtained is a flush tank for a toilet.
One lead-lined watertight tank with valve, and float control which closes valve as water level drops. This is necessary only where disinfectant is introduced into suction of pump.

at times of extreme turbidity excessive quantities are required. In the treatment of the Baltimore City water, as high as 3 parts per 1,000,000 of available chlorine, or 75 lb. of hypochlorite to the 1,000,000 gallons, have been used on raw water.

The amount necessary in many instances depends also upon the character of attention given the apparatus.

RESULTS OF DISINFECTION.

It is by no means a fact that the disinfecting plants in Maryland have been operated with complete satisfaction, for most of them have had trouble of some kind. The difficulties encountered could generally have been avoided with more attention to proper operation. With hypochlorite plants the principal annoyance has been due to the formation of coatings, which clog the pipes; and, where the solution was particularly strong, the materials of which the piping was made have been attacked, necessitating the replacement of parts. These are not serious troubles, however, and can be eliminated by frequent inspection. In the case of liquid chlorine plants it has been found

* From a paper read before the New England Waterworks Association.

that occasionally a part becomes corroded and requires replacement, or a valve gets out of adjustment, but the gradual perfection of apparatus is making such occurrences less frequent.

Where faithful and intelligent attention has been given to operation, and the amount of disinfectant used has not been excessive, few complaints have been made regarding tastes or odours in the water. In one instance, where a liquid chlorine plant of the manual control type was disinfecting water, the flow of which fluctuated considerably, there was always an overdose at night, which caused complaint due to tastes noticeable during the early hours of the day. This, of course, was the fault of the method employed, and not of the treatment itself. In general, fewer complaints have been registered regarding disagreeable tastes where liquid chlorine was used than in the case of hypochlorite.

DECREASE OF TYPHOID.

There has been a marked decrease in the prevalence of typhoid fever in some of the communities where disinfecting plants have been installed. In most cases, however, the period of operation has been so short, and, on account of the small size of some of the places, the appearance of typhoid so irregular, that records do not clearly indicate the effect produced.

EMERGENCY DOSING APPARATUS.

In order that prompt remedial measures may be instituted when a water supply is at any time found to be in an unsafe condition, or when an outbreak of typhoid fever casts suspicion on a water previously untreated, the engineers of the State Board of Health are all instructed in the setting up of an emergency hypochlorite dosing apparatus, making use of ordinary and easily obtainable materials. A sketch showing the general arrangement of the device used, including a bill of material, has been prepared, and is usually sent ahead, so that the necessary material may be ready when the engineer arrives at his destination. This apparatus, shown herewith, has proven its value on many occasions, and several of the installations are still in operation.

Basing judgment on experience in Maryland, it may be stated that, where chlorinating plants for water supplies are given faithful and intelligent attention, their use is decidedly a success, and they provide an effective and inexpensive method for treating many water supplies which do not need filtration, as well as for safeguarding those supplies for which filtration, although desirable, is prohibitive. Unfortunately, there seems to have been some tendency among manufacturers to convey the impression that little attention need be paid to the operation of a liquid chlorine plant. This has given the operator the impression, in some instances, that the apparatus can be entirely neglected. While it is true that little or no difficulty need be experienced, except when parts give out, neglect is certain to cause irregularity in dosing, exposure in certain cases to freezing and other undesirable results. Greater efficiency from some of the disinfecting plants in Maryland is to be expected in the future, as the State Board of Health will be enabled to make more frequent inspections than in the past. This will be made possible by the fact that, in addition to the main office of the engineering division, there are maintained four offices in various parts of the State, at each of which there is a resident engineer who has direct supervision over sanitary engineering matters in his district. Without an effective system of control, disinfection would fall short of giving entire satisfaction in connection with many small water supplies.

Town Planning in East Birmingham.—The Birmingham Town Council have received the sanction of the Local Government Board to the preparation of an amending scheme of town planning for East Birmingham.

Proposed Blackpool Improvement.—A special highway sub-committee recommend the Blackpool Town Council to promote a Bill in Parliament to embrace amalgamation with Bispham, the extension of the promenade at South Shore at a cost of about £60,000, and the erection of two open-air swimming baths on the foreshore at a cost of about £16,000 each. The borough surveyor, Mr. J. S. Brodie, has prepared plans of the proposed swimming baths, each of which is to measure 400 ft. by 200 ft.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not to be hoped that the statement of the engineers to the Road Board, appearing as an appendix to the recently-issued annual report of that board, with regard to the behaviour of certain materials in the road-testing machine, will be amplified in any further reports that may be made hereafter, with some definite conclusions as to what to introduce and what to avoid in the composition of these artificial "asphaltic" carpets? Would not some definite pronouncement by those who have the advantage of making these tests be of incalculable value to those road engineers who are not so favourably informed?

* * * *

Is it not rather interesting to note that the cost of rolling the roads in the Belper Rural District, as given in the issue of THE SURVEYOR of the 25th ult., comes out at 13·11d. per ton of metal consolidated, whereas the cost of this work in Buckinghamshire, several years ago, was 14·24d. per ton, although in the latter case the steam rollers were hired? If depreciation of the rollers had been included in the case of Belper, would not the cost have practically worked out at almost exactly the same as in Buckinghamshire?

* * * *

Are the Municipality of Johannesburg well advised in their proposal to underdrain 12 acres of land at their sewage farm at Klipspruit with 4-in. pipes, laid 3 ft. deep and 50 ft. apart, in order to improve the effluent from their farm, as stated in *South African Engineering* of August last? Is it not now well known that land which is incapable of filtering sewage cannot be improved by subdrainage, as the drains pass the effluent direct to the outfall, and that land that is capable of filtering is in no way improved by subdrainage, except by a very few intercepting drains? Should not this municipality stay their hands and reconsider the proposal?

* * * *

Is it a fact, as recently stated in a building contemporary, that, if the finished surface of cast-iron is marked in any way with white chalk it will rust the iron in such a manner that it will persist for years after all traces of this marking have been apparently wiped off? As all chalk has been formed under the sea, is there any connection between this remarkable action of chalk on cast-iron and the action of sea-water on iron, which is now engaging the attention of scientists?

* * * *

Was it not an excellent idea of Lieutenant R. D. T. Jones, Royal Engineers, to ask engineers to send him all their old cloth tracings and unused tracing cloth, in order that these might be boiled, washed, and sterilised, and converted into bandages, pillow-cases, &c., for soldiers' hospitals? Would not all surveyors and engineers be doing a kind and useful work by sending him this old tracing cloth, addressed to him at the Ministry of Munitions Explosives Department, Storeys Gate, Westminster, S.W.? Is there not an existing tradition that underpaid draughtsmen in the "old days" used to annex all the tracing cloth they could in order similarly to treat it and make shirts for themselves and their families?

* * * *

Is not the ubiquitous surveyor a jack of trades and master of all? Is not the surveyor of Bognor to be congratulated on the success which recently attended a "demonstration" in aid of the Royal West Sussex Hospital, and which the local press attributed to Mr. Bridges' ability, ingenuity and energy, and mentioned that nearly all the tableaux were the outcome of his skill and design?

Municipal Employees Exempted.—At the Kingston, Surrey, Tribunal conditional exemption was, on the application of the borough surveyor, Mr. R. H. Clucas, granted to three men engaged in various capacities at the corporation sewage works.—The temporary sanitary inspector and surveyor to the Maldens and Coombe Urban District Council, aged thirty-eight, was on Saturday granted further exemption to November 30th, on the grounds of domestic and financial hardship.—Appellant, who had been passed for home service, has five children, of whom one is serving in the Army in France.

Association of Managers of Sewage Disposal Works.

VISIT TO SUTTON, SURREY.

A meeting of the Metropolitan District of the above association was held on Saturday last at Sutton, Surrey. The attendance included Mr. W. Hedley Grieves (surveyor to the Sutton Urban District Council), Mr. F. G. Barstow (assistant surveyor), Mr. Joseph Taylor (manager of sewage works), Mr. J. B. Croll (Richmond, Surrey), Mr. T. Hughes (Hampton), Mr. E. D. Holgate (Grays), Mr. J. H. Barford (Maidenhead), Mr. A. Eade (St. Albans), Mr. E. Lindon (Wanstead), Mr. H. Duckworth (Hertford), Mr. W. Turner (Wembley), Mr. S. Duxbury (Maldens), Mr. J. Craig (Romford), Mr. J. Bibby (Biggleswade), Mr. T. Flucker (Romford), Mr. Reginald Brown, M.INST.C.E. (Southall-Norwood), Mr. A. Scott Murray (West Kent Main Sewerage Board), Mr. E. J. Silcock, M.INST.C.E. (Westminster), Mr. J. Blizard, ASSOC.M.INST.C.E. (Southampton), Mr. J. E. Webb and Mr. A. E. Hammond (Hendon), Mr. W. G. Rich, Mr. W. H. Rogers, and Mr. H. Dyson (Haslemere), Mr. J. Brown (Ealing), Mr. W. Haywood (Brentford), Mr. R. Ames (Nottingham), and Mr. P. Keap (London).

The members met at the offices of the urban district council, where they were received on behalf of the council by the chairman, Councillor J. Wakeford, J.P. In extending a hearty welcome to the visitors, Mr. Wakeford recalled that eight years ago, when he happened to occupy the same position he did now, he had the privilege and pleasure of greeting a similar gathering to that which he was now addressing. Although they had no historical places of interest at Sutton to show them, they claimed to be more or less pioneers in the particular description of sewage disposal which, since its inauguration here, had been universally commended throughout the civilised world. He might say that they had as one of their colleagues on the urban council Mr. Chambers Smith, who was at one time surveyor to the council, and helped in the commencement of the sewage disposal scheme which they were working to-day. They congratulated themselves upon having such a gentleman on their council, and that they had his help in carrying out the important task entrusted to them.

Mr. Wakeford having retired from the chair, the chairmanship of the meeting was assumed by Mr. W. L. Strachan (Aldershot).

A vote of thanks to Mr. Wakeford was moved by Mr. J. D. Croll (Richmond), seconded by Mr. J. H. Barford (Maidenhead), and carried by acclamation.

Mr. W. HEDLEY GRIEVES, engineer and surveyor to the council, then proceeded to read some—

NOTES ON THE SEWAGE DISPOSAL AND PURIFICATION WORKS AT SUTTON.

Mr. GRIEVES said: I have much pleasure in adding my welcome to the association to that of the chairman of the council, on the occasion of their second visit to the Sutton Sewage Disposal Works. It is ten years since I had the pleasure of welcoming the association to the Buxton Sewage Works, during the time that I held office there as engineer and surveyor. Buxton, like Sutton, was looked upon in those days as one of the pioneers of sewage purification, for at Buxton the Local Government Board granted a loan for the borrowing of £1,600 for extensions to their works, without imposing the necessity of purchasing additional land for land treatment. That was the first time for which the sanction had been received without that imposition. Then again, Buxton led the way in the provision of percolating rotary sprinklers, for when they put down the scheme of seven sprinklers of various sizes, that was the largest installation at that time in this country. Some years prior to that—namely, in the year 1896—Mr. W. J. Dibdin, who at one time was a member of this council, suggested, as a consequence of the successful experiments carried on by the Massachusetts State Board of Health, the construction of a bed for the treatment of crude sewage without the aid of chemicals or settling tanks, and in November of that year, in my predecessor's time, the first of its kind ever constructed in this country was put into operation. This bacteria bed was composed of lumps of burnt clay ballast of 2 to 4 in. gauge and 3 ft. 6 in. in depth. Upon this was passed the crude sewage without any previous sedimentation, floating paper only being removed by screens. The sewage was held up in the bed for two hours, and the outlet valve was opened, and the effluent from which the fouler organic matter was destroyed by the agency of bacteria formed in the bed was drawn off and led on to another filter, called a fine-grain bacterial bed, the media being breeze of a gauge of from ¼ in. to ⅜ in. The effluent was similarly retained in this bed for two hours, after which it was drawn off and discharged direct into the Pylbrook. Everyone remembers how the system thus inaugurated at Sutton seemed to alter the whole aspect of sewage treatment, and it was hoped would solve the great question of dealing with the sludge in sewage. But we still have the sludge problem with us, and, although the bacterial system then introduced has revolutionised the whole question of sewage treatment, the difficulty of disposing satisfactorily of the sludge has not been disposed of. The visitors' book at the farm will show how the new departure was received, for representatives from local authorities, not only in this country, but practically from all over the world, have visited the works, and the biological process was adopted in some form or other by many other public authorities.

When it was found that in the working of these coarse grain beds the capacity, owing to mineral and other matters, was reduced to such an extent, it was decided to adopt sedimentation or septic tanks, in order to prolong the life of the beds.

The Sutton Sewage Works were originally constructed some twenty-five years ago, and comprised an area of about 25 acres. At that time they were designed for the treatment of the sewage by chemical precipitation and broad irrigation. In this process lime and sulphate of iron were added to the sewage before it ran into the settling tanks, of which there were six, of the capacity of 50,000 gallons each. In these tanks the sewage was allowed to rest for a number of hours when the solids in suspension were precipitated to the bottom of the tank. The clarified sewage was then drawn off by floating arms, and then deposited upon the land. The sludge was drawn off and pressed into cakes, which were found to be unsaleable. The clay subsoil of the land upon which the effluent was turned was found to be unsuitable for purifying the sewage from the precipitation tanks, and complaints were received of the impurity of the effluent. It was then that the double contact system was brought into operation. The sludge pressing machine was sold and the sludge lagoons now in operation are used in their place.

The area of the district is 1,836 acres. The estimated population is 22,500. The birth-rate is 17·8 per 1,000 and the death-rate 9·3. The rateable value is £169,000.

HIGH-LEVEL WORKS.

The sewage is delivered to the works by two levels—namely, the high level and the low level. The average daily flow of the high-level sewer is about 500,000 gallons, and that of the low level 250,000. The separate system of sewage is in vogue in the district. When the sewage is delivered at the high-level works it is passed into three septic tanks with a capacity of about half a day's flow. Part of the sewage is then passed on to contact beds, and the remainder on to percolating filters.

There are five coarse and seven fine grain beds at the high level, with a capacity of 351,000 gallons. There are also two percolating filters, each with a diameter of 80 ft. and 5 ft. 6 in. deep, supplied by Messrs. Adams-Hydraulics, Limited, and one filter 100 ft. diameter, supplied by the Ames Crosta Engineering Company. The latter was constructed in 1913. The first sprinkler was constructed in 1908, and the second in 1909. The 100-ft. sprinkler is only 3 ft. 9 in. deep.

The coarse or first contact beds take one hour filling, two hours in contact, and one hour emptying; then the fine beds take one hour to fill, two in contact and one to empty. It will be seen that the sewage from the time of leaving the septic tank to leaving the fine contact bed takes eight hours.

The adoption of percolating sprinklers will effectively do away with the contact beds, as the experience we have found is that not only does the contact bed require more space and more time in the process of purification than the sprinkler, but the effluent from the contact beds is not so satisfactory. The sewage from the percolating filters after leaving

the septic tank is discharged into the stream in two hours, as against eight for the contact bed. When the last sprinkler was constructed at the high-level works a new humus chamber 35 ft. square was constructed; this contains two hours' flow.

LOW-LEVEL WORKS.

Here there are three septic tanks, with a total capacity of 103,000 gallons. There are five coarse and five fine beds at the low-level works, and one 80-ft. diameter rotary sprinkler, which is one of the Candy-Whittaker type. Part of the sewage after passing through the septic tanks is passed on to the sprinkler and the remainder to the coarse and fine beds; but to-day the chairman of the Farm Committee will formally start a new sprinkler 66 ft 6 in. diameter, which has been supplied by the Ames Crosta Engineering Company.

This sprinkler has been constructed on the site of two fine-grain beds, which, after to-day, along with the two corresponding coarse-grain beds, will be dispensed with, and the committee at their last meeting decided to construct during the next half-year another sprinkler exactly similar to this one. The depth of these sprinklers is 3 ft. 6 in. The filtering media has been supplied, as in the case of the last 100-ft. sprinkler, by Mr. Frank Keep. At the low-level works we have very little fall between the inlet of the sewage and the screen into which the whole of the effluent is turned; therefore it was necessary to construct the 80-ft. filter below the surface of the ground.

THE EFFLUENT CROPPING, AND DISPOSAL OF SLUDGE.

The whole of the effluent on both high and low level beds discharges directly into the Pylbrook, which is under the jurisdiction of the Port of London Authority, who regularly takes samples of the effluent from the various beds. Although the land originally intended for the purposes of irrigation is of the heavy London clay and is not used at all for irrigation purposes, with the application of ashes and the sludge from the works, it makes capital land for growing crops upon. The crops that are being cultivated at the present time are potatoes, on about 4 acres, and lucerne on about 7 acres. Other crops that have been grown at various times are mangolds, swedes, peppermint and rye-grass. The average amount received by the sale of the various crops during the last three years is £80 to £90 per annum. We have only grown lucerne for about two years, and it has proved to be a profitable crop. Already we have had two crops this year, and the third is being got. Osiers have also been grown as well as cricket bat willows.

The sludge from the sedimentation tanks from the high-level works is discharged three or four times a year by gravitation to the sludge lagoons. That from the low-level tanks is pumped to the high level. There are three lagoons, one of which was constructed two years ago. The drainage from the lagoons is discharged into the low-level sedimentation tank, and when the sludge is dry it is carted up and put out on to the farm, or brought away by farmers, a charge of 4d. per load being made.

There are two 8-h.p. Atkinson's gas engines, one 3½-h.p. engine which was used for mixing chemicals, one air compressor, and two ram pumps capable of lifting 20,000 gallons each per hour against a head of 32 ft. One engine and one pump are used once a week for pumping the sludge out of the low-level tanks into the high level. The remainder of the machinery is not now used.

WORKING COSTS.

I submit a statement of the cost of working the sewage farm for the last few years. This includes

March.	Sewage disposal.	Sewage farm.	Works extension.	Total.	Income for year.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1910	530 14 11	270 5 0	970 2 0	1,771 0 11	115 7 5
1911	590 14 6	265 5 3	292 17 0	1,148 16 11	153 19 9
1912	580 0 9	297 15 0	—	897 15 9	298 7 1
1913	685 18 4	331 2 1	1,226 14 4	2,174 14 9	226 19 4
1914	559 17 9	290 15 8	280 18 4	1,169 11 9	160 3 1
		Rebuilding stables	64 3 4		
1915	547 11 0	271 0 6	13 19 6	930 3 4	134 9 8
	£4,434 17 3	£1,768 0 8	£2,887 14 6	£8,031 1 5	£1,118 6 4

the improvements that have been carried out by administration and out of current rate without having to apply to the Local Government Board for sanction to borrow.

In concluding this statement I would like to express my gratitude to the chairman of the committee, and the members of the council generally, for their assistance in carrying out duties, oftentimes difficult and arduous, and to express my satisfaction at the loyalty and devotion to duty of Mr. Joseph Taylor, the manager at the farm, who has superintended the carrying out of the improvements made from time to time, and whose practical knowledge is of the greatest value.

The company were conveyed in vehicles to the sewage disposal works in Clensham-lane, and were agreeably surprised to note that the approach to the works is tastefully laid out with flowers and shrubs, resembling the entrance to a park, and that almost on every hand flowers formed a welcome feature of the scene. After an inspection of the various objects of interest the visitors assembled at the low-level works for the formal inauguration of the new 66-ft. sprinkler.

Mr. R. W. Wootten, chairman of the Sewage Farm Committee, after a brief explanatory statement, turned on the flow of sewage to the new sprinkler.

Mr. Chambers Smith, in moving a vote of thanks to Mr. Wootten, said it was twenty years since the bacterial system of treatment was adopted. It was put down at Sutton with the assistance of Mr. Dibdin in 1896, and for three years they received 300 deputations yearly to inspect the works. Sutton had been called the Mecca of the bacterial sewage purification process, and it undoubtedly was. The contact-bed system was very good, but a process of advancement and evolution was effected by the introduction of the percolating filter.

Dr. Hooper seconded the proposition, which was duly carried.

After tea, which was generously provided by the members of the urban council, Mr. Reginald Brown (Southall-Norwood) said he noticed that at Sutton they had an extremely low death-rate, but he could not congratulate them upon an extremely low birth-rate, for they wanted a high birth-rate. As to the works, they could not leave without giving expression to the admirable way in which these had been constructed, and the admirable way in which they had been arranged by Mr. J. Taylor. No engineer could hope for a better works manager than Mr. Grieves had. It was no use putting a man in charge of a ship unless he had a good lieutenant, and a good lieutenant should be well paid. As a rule, local authorities were willing to spend with both hands for a water supply and for taking the waste water into the sewage works, but when it got there it was a case of out of sight out of mind. They forgot about the all-important thing of conveying the water back to the river purified. He was quite certain there was no better effluent in the whole of Surrey than that which came from the Sutton sewage disposal works. Mr. Brown concluded by moving a vote of thanks to Mr. Taylor for his attention to the visitors.

Mr. J. H. Blizard (Southampton), in seconding, remarked that the visit had proved very instructive. He was greatly impressed with what he had seen, and he would suggest that the fish pond near the outlet should be considerably enlarged. He also suggested that as they aimed at beautifying the sewage works with plants and shrubs, they should make them a show place for the inhabitants and invite them to see the beauties of the place, and how the money was being spent. He felt that sewage disposal works were quite as important to the community as waterworks.

Mr. Wakeford, chairman of the urban council, expressed his indebtedness to the Ames Crosta Engineering Company and to Mr. Frank Keep for the way they had worked with the council. They had helped very considerably in getting things through, and such assistance was particularly valuable in these awkward times. The members of the committee felt very pleased indeed with the way these gentlemen had carried out their work.

Mr. J. Duxbury (Grays), in moving a vote of thanks to Mr. Grieves, said he was very pleased to see the state of the works when the labour difficulties were considered. He hoped the members of the urban council would feel that if they wanted to keep men they must pay them at the same rates as other men were paid in the labour world. They must remember that it was a difficult thing to get men to look after sewage disposal works.

Mr. J. Hughes (Hampton) seconded, and remarked that he had noticed several improvements in the works since his previous visit some years ago. The percolating filter was an improvement, and he thought they had proved that at Sutton. He was gratified

to find that the members of the urban council took so much interest in the sewage works.

Mr. Taylor briefly acknowledged the compliment.

Mr. Grieves emphasised the value of visits of inspection to various sewage disposal works, and with regard to Messrs. Ames Crosta and Mr. Frank Keep, he said they were greatly indebted to those gentlemen. He believed the new sprinkler would prove a very satisfactory job, and he was sure they could not be better supplied with media anywhere. He quite agreed with the suggestion about beautifying sewage disposal works. Alluding to the presence that day of many councillors, including several lady councillors, Mr. Grieves said it helped an official to find he was supported by the members of the local authority.

Mr. Reginald Brown, commenting on the cost of the works per head of the population, said the cost at Sutton was exceedingly low.

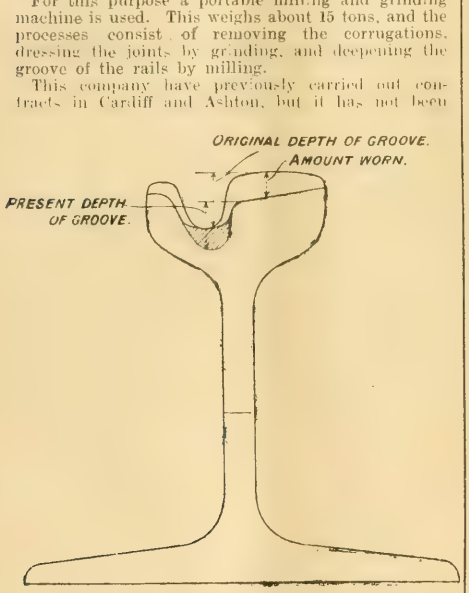
In reply to Mr. J. A. Webb (Hendon Rural District Council), Mr. Grieves said the inclusive cost of the new installation was £350.

REMODELLING TRAMWAY RAILS IN WIGAN.

The Woods Gilbert Rail Planer Company, Limited, have recently completed a contract with the Wigan Corporation under the borough engineer, Mr. A. T. Gooseman, for remodelling 4 miles of tramway track, and the work has been such a success that further contracts have been entered into.

For this purpose a portable milling and grinding machine is used. This weighs about 15 tons, and the processes consist of removing the corrugations, dressing the joints by grinding, and deepening the groove of the rails by milling.

This company have previously carried out contracts in Cardiff and Ashton, but it has not been



Section of Tramway Rail Before and After Deepening.

used very extensively in this country. Many miles of track have been remodelled by this process in Australia.

Before the track at Wigan was remodelled the rails were completely worn out. The wheel flange was right at the bottom of the groove, which was only ⅛ in. deep, and in some cases less. A ¼ in. has been drilled out of the groove bottom, leaving a new groove ⅜ in. deep, which will add at least five or six years' life to this track, at a cost of £530 per mile. This has turned out a great war-time saving.

The machine originally had a petrol engine. This created a great noise, however, and the machine now runs with electric motors, with the result that the noise nuisance has been abolished.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

BRITISH DE-TINNING SCHEME.

ACCEPTANCES FOR FORTHCOMING MEETING IN LONDON.

Appended is a full list of the local authorities who up to the time of going to press have intimated their intention of being represented at the forthcoming meeting in London at which the British De-Tinning Company will outline their scheme for enabling those bodies in future to participate in the profit derived from the utilisation of their waste metals. The figures in parentheses denote the population of the various towns and districts.

Acton (60,000), Aylesbury (11,000), Accrington (45,000), Bushey (7,000), Brentford (17,000), Basford (42,000), Barnes (14,000), Blackwell, Buckingham (3,000), Beckenham (32,000), Battersea (168,000), Beddington and Wallington (18,000), Barry (5,000), Colchester (44,000), Chelmsford (18,000), Chiswick (39,000), Cheshunt (13,000), Caterham (11,000), Colne (26,000), Colwyn Bay (13,000), Carshalton (12,000), Chatteris (5,000), Chingford (8,000), Chesterfield (38,000), Darlington (56,000), Deptford (110,000), Daventry (4,000), Dorking (8,000), Dover (44,000), Dartmouth (7,000), Easthampstead (3,000), Epsom (19,000), Exmouth (12,000), Edmonton (65,000), Enfield (56,000), Exeter (37,000), Ealing (61,000), East Ham (134,000), Finchley (40,000), Farnborough (14,000), Fulham, Finsbury (10,000), Folkestone (34,000), Grimsby (75,000), Glasgow (785,000), Grays (16,000), Greenwich (96,000), Guildford (24,000), Gainsborough (21,000), Hannon-on-the-Hill, Hampton (9,000), Horsham (11,000), Hemel Hempsted (13,000), Hounslow (31,000), High Wycombe (20,000), Hereford (23,000), Harwich (14,000), Ipswich (74,000), Ilkeston (32,000), Ilchen, Kingston-upon-Thames (38,000), Keighley (44,000), Loughton (5,000), Loughborough (23,000), Luton (50,000), Lewes (11,000), Lichfield (9,000) Limerick 50,000), London (City), Malvern (8,000), Market Harborough (9,000), Margate (27,000), Morecambe (12,000), New Malden (16,000), Northampton (90,000), Norden, Nuneaton (27,000), Portsmouth (231,000), Paddington, Purley (3,000), Retford (18,000), Rochester (32,000), Ramsgate (30,000), Richmond, Surrey (33,000), Reigate (29,000), Southgate (34,000), Surbiton (18,000), Sutton Coldfield (20,000), Salford (232,000), Swadlincote (4,000), Slough (15,000), Stroud (9,000), Southampton (119,000), Scarborough (37,000), Southend-on-Sea (63,000), St. Pancras, Sudbury, Suffolk (7,000), Stoke Newington (51,000), Stepney (280,000), Sheringham (4,000), Sutton 21,000), Seaford (5,000), Shoreham-by-Sea (6,000), Sheffield (460,000), Stapleford (8,000), Swansea (115,000), Swaffham (3,500), Skegness (4,000), Tonbridge (15,000), Tunbridge Wells (36,000), Twickenham (29,000), Teddington (16,000), Worthing (30,000), Walthamstow (125,000), Wellington (8,000), Watford (41,000), Windsor (13,000), Wembley (11,000), Woolwich (121,000), West Bridgeford, Ware (6,000), Walsall (92,000), Wokingham (4,000), Wandsworth (311,000), Woodford, Essex (19,000), Westminster (City) (160,000), Wood Green (50,000).

THE SOUTHWARK WORKS.

Pressure on our space makes it impossible to publish this week the plans of the de-tinning works which are being erected at Southwark, but we hope to be able to include them in our next issue.

Housing After the War.—A deputation to Mr. Walter Long on Wednesday from the Housing and Town Planning Congress which met some months ago to consider after-the-war problems, asked the Government to set aside £20,000,000 to make advances to local authorities and other agencies to enable them to provide houses for the working classes at reasonable rentals. Mr. Long replied that he was not going to make any announcement as to any particular sum. He was not at all sure that twenty millions was even an index of what might be required. If the Government came to the assistance of local authorities it must be on liberal lines. There should be generous consideration shown to country districts, because it was vital to the future of the race that there should be provision for as many as possible in the country districts in order to keep occupied on the land as large a population as possible. In regard to the demand that the legislation promised by the Government in 1913 and 1914 to amend the Finance Act of 1909 in order to remove an obstacle to the building of working-class houses should be carried, Mr. Long said that he regarded the Government as pledged to carry a measure of reform, and he hoped that when it came it would be complete, because he was confident that it was necessary.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Argyll C.C.—The Lorn District Committee have received an intimation that the Road Board will be prepared to make a grant of £5,000 for the construction of the bridge over the Clyde.

Margam U.D.C.—The question of the provision of a public mortuary is under consideration.

Morley T.C.—It is proposed to construct a public convenience in Bridge-street.

HOUSING AND TOWN PLANNING.

Knaresborough U.D.C.—A letter has been received from the Local Government Board asking if the council had considered the advisability of applying for sanction to a scheme under the Town Planning Act for the preservation of certain amenities, and incidentally referring to the question of securing control of the River Nidd and banks as mentioned by the council in letters. Councillor Cassells: Does that mean if we adopt the Act we get control of the river banks as well? The chairman (Mr. J. Stead): It seems rather a remarkable thing, the board now asking us to do something for which we made application only a month ago and which was not then entertained. It is the very thing we asked permission for, the obtaining and preserving of the river bank. The council sent the matter to the General Purposes Committee for report.

Sunderland T.C.—The town council on Wednesday adopted an instruction to the Health Committee to consider and report upon the adequacy of the housing provision in the borough for the working-class population.

MOTOR TRANSPORT.

Bradford T.C.—It has been agreed to purchase for £500 a 2-ton petrol dust-cart tip wagon, for the use of the team labour department.

Elland U.D.C.—An estimate is to be obtained for the conversion of a horse ambulance into a motor ambulance.

Littlehampton U.D.C.—The council are considering the purchase of a motor fire engine.

REFUSE COLLECTION AND DISPOSAL.

Dufftown T.C.—The surveyor, Mr. H. McKay, has reported in favour of a weekly collection of house refuse. He said he found in the course of inquiries that eight or nine ashpits had not been cleaned out for nine months.

Tiverton T.C.—The borough surveyor, Mr. J. Siddall, reports that during the past six months waste paper has been collected to the value of £20 14s. 2d. The weight of the material was 11 tons 12¾ cwt., and the cost of collection and baling expenses £16 12s. 9d., leaving a balance of £3 1s. 5d. Added to this is the saving on the cost of hauling to the refuse tip, thirty loads at 2s. 6d. = £3 15s., making a saving on the six months of £7 16s. 5d.

ROADS AND MATERIALS.

Blackburn T.C.—A sub-committee has been appointed to consider the question of the wages and reorganisation of the street sweeping department.

Holland C.C.—The council have sanctioned an expenditure of £267 on tar-spraying the Boston to Skeggness road, the Road Board having agreed to contribute 40 per cent of the cost. It has been decided to appeal for exemption from military service for Mr. A. W. Lloyd, the surveyor for South Holland.

Kiveton Park R.D.C.—The Local Government Board were at a recent meeting criticised by the council for refusing permission to improve Leopold-street, Dinnington, the cost of which the owners of property in the street have offered to meet.—The chairman described the thoroughfare as a quagmire, but the Local Government Board expressed the opinion that this was not a fitting time for street improvement, even though there would be no cost to the ratepayers.

Linlithgowshire C.C.—Strong protests were made at the Linlithgow District Committee on Monday on the subject of the heavy motor char-a-banc traffic on the Queensferry to Edinburgh road. It was stated that, while £3,000 had recently been expended on the repairing of this road, it had been reduced again to a very bad condition by this traffic. It was agreed that steps should be taken to have the motor traffic modified.

Rhyl U.D.C.—The council have decided to accept a tender of £279 for providing screens on the foreshore for preventing sand-drift, but they have declined to accept the only tender received for removing the remains of last winter's huge drift, instructing the surveyor, Mr. A. A. Goodall, to obtain prices for plant and the cost of removing the accumulation by local labour.

Taunton T.C.—The Streets and Highways Committee stated that the Somerset County Council, when making payment for the maintenance of the main roads in the borough during the year ended March 31st last, deducted the sum of £85 from the amount claimed by the corporation. This step was consequent upon a communication received from the council last year, when it was suggested that a saving could be effected if the roads were scarified by mechanical means instead of by hand labour, the suggestion being supplemented by an intimation that the county authority would in future only be prepared to pay for scarifying upon the basis of the proper cost per superficial yard of effective steam scarifying. The town council in the circumstances have appealed to the Local Government Board to determine the amount of the payment to be made by the county council in respect of the maintenance of the main roads in the borough during the past year.

SEWERAGE AND SEWAGE DISPOSAL.

Belper R.D.C.—It has been agreed to inform the Local Government Board that the works contemplated by the council after the war will include the Allestree Bridge, Crich, and Horsley Woodhouse sewerage schemes and the Allestree water supply.

Stockbridge U.D.C.—The surveyor, Mr. G. W. Battye, has been instructed to report on the proposed sewerage extension at Hawthorn Brook, and on the question of sewage disposal.

Weston-super-Mare U.D.C.—The council have adopted a scheme prepared by the surveyor, Mr. H. A. Brown, for dealing with the present unsatisfactory condition of the Milton sewage pumping station. The work, which involves the erection of a new station on an adjoining site and the provision of ejectors operated by compressed air from the waterworks pumping station, will be commenced as soon as possible.

WATER, GAS, AND ELECTRICITY.

Brighton T.C.—The Lighting Committee have submitted a report on a proposal to lease a site at the electric power station at Shoreham Harbour to the British Coalite Company, Limited, for the treatment of coal for the production of a high grade smokeless fuel and other distillates used largely in the manufacture of dyes, high explosives and oils. The company propose, in return for the concession, to sell to the corporation, at a low rate, a large surplus volume of gas of good calorific value, suitable for firing boilers. The corporation would have to expend at least £750, plus the cost of pipes, to adapt a section of their present boilers for burning gas instead of coal, and it is estimated that by so doing a reduction of about one-half in the cost for fuel for the production of the units thus generated will be effected.

Goole U.D.C.—It has been decided to increase the price of gas to ordinary consumers from 3s. 6d. to 3s. 9d. per 1,000 cubic feet.

Nelson T.C.—Negotiations are proceeding with the Ministry of Munitions with respect to the installation of a benzol recovery plant and rotary washer-scrubber at the Brierfield Works. The department were unaware that vertical retorts were installed at the works, and they asked that samples of tar should be forwarded to the technical expert in London for

analysis, prior to the installation being proceeded with.

Preston R.D.C.—The question of the proposed supply of 50,000 gallons of water daily to new works of Leyland Motors, Limited, at Farington, has been referred to the Water Committee.

Weston-super-Mare U.D.C.—A special committee has been appointed to consider the desirability of carrying out certain suggested improvements at the waterworks pumping station.

Kirkcaldy T.C.—The town council have decided to engage Sir John Snell to report on the whole question of the supply of electricity in the burgh.

Halstead U.D.C.—Upon the suggestion of the surveyor, Mr. J. R. Fayers, it has been agreed to instal a water level indicator at the main pumping station, for the guidance of the engineer, and an indicator and recorder in the office for the checking and recording of water levels and working of engines and pumps. It is proposed to include a sum of £90 in the estimates to cover the cost.

MISCELLANEOUS.

Buckie T.C.—The town council have provisionally resolved to schedule the following works among the schemes to be carried out after the war: (1) Completion of original scheme of harbour extension; (2) provision of workmen's houses; (3) paving of Low-street and Commercial-road.

Esher and the Dittons.—On the ground of the higher cost of living, the eighty-two workmen in the outside department of Mr. H. C. Fread, the surveyor, have hitherto received a work bonus of 2s. a week each. This has now been increased to 4s. per week.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Neath T.C. (September 13th. Mr. George L. Pepler.)—This was an inquiry into an application for authority to prepare a town planning scheme, with reference to an area situate within the parish of Llantrait Lower in the adjoining rural districts.—The town clerk (Mr. Edwin C. Curtis) and the borough engineer (Mr. D. M. Jenkins) represented the corporation, and gave the necessary explanations and evidence in support of the application. The chairman, clerk and engineer of the Neath Rural District Council also attended, to support the application. This is the second application made by the corporation under the Housing and Town Planning Act, and the additional area now in question is intended to be combined, under one scheme, with the area within the borough for the town planning of which the authority of the Local Government Board has already been obtained.

APPLICATION FOR LOAN.

Blackburn T.C.—£10,450 for the completion of Parsonage reservoir.

LOANS SANCTIONED.

Bradford T.C. £3,700 for the purchase of three electric tipping wagons.

Leeds T.C.—£20,000 for electricity mains, and £15,000 for new sub-stations.

Wembley U.D.C.—£667 for the Ealing-road improvement.

FORTHCOMING INQUIRIES.

SEPTEMBER.	£
26. **Wigan.** For works of sewerage (Mr. W. O. E. Meade-King)	3,515

FOR OTHER ADVERTISEMENTS

See End of Paper.

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Junior Assistant, ineligible for the Army. Candidates must be neat draughtsmen, and should be able to make surveys and take levels. Salary £80 per annum. Applications, stating age, qualifications and experience, should be accompanied by copies of not more than three testimonials, and be sent to the undersigned, endorsed "Junior Assistant."

GORDON R. FOLLAND,
Acting County Surveyor.

Wells, Somerset. (3,104)

PERSONAL.

Police-constable Longhurst was at Bow-street on Monday presented with £10 for descending a main sewer at Woolwich and rescuing a man overcome by gas.

Mr. H. Lee Jones, assistant borough surveyor of Denbigh, has been appointed surveyor and inspector to the Elland Urban District Council, in succession to Mr. F. W. Tillotson.

Mr. F. Philip, road surveyor to the Ellon district of the Aberdeenshire County Council, has had his salary increased from £185 to £200, and his allowance for travelling expenses increased to £10.

Messrs. J. Prisk, J. Williams, and J. R. Cummins, surveyors to the Helston Rural District Council, have been granted increases of salary for the duration of the war "or until the resumption of normal prices."

Mr. Wentworth Jones, borough surveyor and inspector of nuisances of Thetford, has joined the Army. The town council have resolved to keep his position open for him until the expiration of the war, and make him an allowance of £1 per week.

Mr. E. Holloway, surveyor and sanitary inspector to the Evesham Rural District Council, has been appointed a surveyor to the Royal Flying Corps, and the council have appointed Miss McConnell surveyor and inspector temporarily at a salary of £2 per week.

Lieutenant Herbert James, of Birmingham, who won the V.C. at Gallipoli, figured prominently in the illustrated journals in connection with his marriage last week, at Stoke Damarel Parish Church, to Miss Gladys Beatrice Lillicrap. The bride is the eldest daughter of Lieutenant F. W. Lillicrap, R.E., who was formerly water engineer to the Devonport Corporation.

Corporal Thomas Oldroyd, of the 1/2nd Bucks Territorials (who was a clerk in the surveyor's office at High Wycombe), has been recommended for the Military Medal. A report by Captain and Adjutant G. E. W. Bowyer concerning Corporal Oldroyd reads as follows: "On July 19, 1916, he worked for six hours under fire in communication trench, mending wires, and established communication a few minutes before the attack started, and continued to work instruments in front line under heavy fire. It was solely due to this that successful communication was maintained between front line and Battalion Headquarters throughout the attack."

BARTON HILL BATHS, BRISTOL.*

By H. W. HARDING,
Chief Engineering Assistant, City Engineer's Office.

One of the most interesting sections of this establishment is the bath compartment, known as "Kane's Baths," introduced into this city by the present superintendent of the Bristol Corporation Baths.

The special feature of this bathing compartment is that the bathroom is kept separate from the dressing-room, as it is claimed that, whether slipper, spray or needle baths are the cleansing medium employed, it is essential that the bathing compartment should be maintained at a considerably higher temperature than the dressing compartments, both as a means of more thoroughly cleansing the body and as a preventive of chills to the bather. In addition to this the bather is able to employ a continuous flow of clean water, the soiled water immediately running away.

The system consists of a specially-designed bathroom, lined with white glazed bricks, in which are placed the bath compartments, fitted with slipper, spray, shower and needle baths, or a combination of each, separated from a series of dressing rooms, situated on either side, each opening direct on to a gangway communicating with each bath compartment.

Arrangements are made for the heating of these rooms so that an ample supply of fresh warm air is delivered to each bathroom, at a temperature of 110 deg. Fahr., and to each dressing-room at 65 deg. Fahr.

The heating medium is a steam tubular heater, and high pressure blower, fitted with electrical induction motor, placed in the chamber below the bathroom, which can be worked by the attendant above. Exhaust gratings and flues provided in the adjoining walls (capable of adjustments to suit any conditions) connect up to a ventilating turret on the roof.

Lavatory basins are provided in each bathing compartment

* Extracts from paper submitted at the Southern District meeting of the Institution of Municipal and County Engineers, held at Bristol on Saturday last.

SOME RECENT PUBLICATIONS.*

Waterworks Handbook. By Alfred Douglas Flinn, Robert Spurr Weston and Clinton Lathrop Bogert. (First edition.) Three hundred and eleven tables and 411 illustrations. Price $6. New York: McGraw Hill Book Company.

This handbook, just published, is a compendium of data of every sort for the waterworks superintendent, designing engineer, analyst and inspector. It is in no sense a text-book, although it contains a vast amount of information from which the teacher may abstract valuable lessons for his students, and with which he may illustrate the principles of the science of waterworks engineering. It is not a formal treatise, although the various subjects are taken up in orderly fashion so as to make the book, as nearly as possible, self-indexing. It is a handbook in which the separate, self-contained paragraph is the unit, each paragraph bearing a conspicuous explanatory heading. As for the subject-matter, it is taken from a great variety of sources—old and new—from text-books, engineers' reports, scientific papers, specifications, and even from trade catalogues. References to the original sources are usually given, so that the volume is a guide-book as well as a handbook. Naturally, the authors have drawn largely from their own experience, and in this respect the experiences of the senior author, Mr. Flinn, as deputy chief engineer of the city of New York have been unique among modern writers on water supply. Mr. Flinn has not only been familiar with the details of this greatest of modern water supply undertakings, but he has himself been a large factor in the organisation of the work. Many of the ideas embodied in the specifications of the Board of Water Supply are given in abridged form in the handbook.

The book is divided into five parts, which treat respectively of sources of water supply, collection of water, transportation and delivery of water, distribution of water, and the character and treatment of water.

Part I., comprising seventy-three pages, is devoted to rainfall evaporation, stream flow, and ground water. For the most part these topics are described along the usual lines, but the chapter devoted to evaporation is particularly complete. The chapter on run-off and stream flow contains tables showing the relation between rainfall and run-off of representative watersheds in the eastern part of the United States. This chapter is somewhat incomplete, in that it does not include some of the most recent applications of the laws of chance to rainfall and stream flow.

Part II., on the collection of water, covers 197 pages, and includes chapters on intakes, reservoirs, masonry dams and rock-fill dams, wells and infiltration galleries. Of these chapters, that on masonry dams is the most complete. It is an excellent treatise on the subject, containing many illustrations of high masonry dams. The chapter on wells describes the common methods of drilling wells, the use of test wells, and the air-lift method of pumping water. The chapter on infiltration galleries is disproportionately short.

Part III., on the transportation and delivery of water, covers 112 pages, and discusses in an excellent way the construction of aqueducts and steel and wooden pipes. These chapters contain many facts derived from the author's experience in the construction of the Catskill aqueduct.

Part IV., on the distribution of water, is the longest section of the book, covering 263 pages, and containing twelve chapters. It treats of cast-iron pipes, and special fittings as used in distribution systems, water meters, pumps, distributing reservoirs, standpipes and tanks. There are also chapters on water consumption and hydraulic computations. There are four miscellaneous chapters on masonry and puddle, conversion tables, and miscellaneous topics.

Part V. relates to the character and treatment of water. The chapter on character of water contains tables showing the chemical and biological character of water from different sources, such as rain water, river waters, lake waters, and sea water. Under the heading Inspection of Sources of Water Supply, rules and regulations governing the control of watersheds are given. There are short chapters on storage and sedimentation. The chapter on aëration and chemical treatment is more complete than the preceding, and describes the various chemical processes used for coagulation and disinfection, together with various devices now used for applying chemicals. There is a short chapter on water softening. The chapter on filtration describes the various methods now used, and gives tables of data relating to some more important slow sand filter plants and mechanical filter plants used in America. This chapter also contains the standard forms for filter statistics recommended by a committee of the New England Waterworks Association. The last chapter of the book is a *resumé* of the standard methods of water analysis of the American Public Health Association.

It would be impossible in this brief review to give more than a passing notice to the different topics included in the "Waterworks Handbook." Suffice it to say that the compilation, while not exhaustive, is unusually complete, and there is no doubt that the work will almost immediately find its place on the shelves of waterworks engineers and superintendents as a standard treatise.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

STREET PAVING IN AMERICA.

TYPES OF SURFACING RECOMMENDED FOR BOSTON.

A committee of engineers appointed to make recommendations as to the policy to be followed in repaving the Boston city streets has submitted the following proposals:

Class 1. Heavy Traffic Streets.—Granite blocks laid on Portland cement-concrete base not less than 6 in. in thickness, the joints to be filled with Portland cement-grout; in the case of excessive grades, pitch to be substituted for grout in the upper inch or so of the joints in order to provide better foothold for horses.

Class 2. Main Arteries.—The same type of pavement as Class 1, with a few exceptions where the surroundings require a smoother and less noisy surface, such as wood blocks or the best grades of bituminous pavements.

Class 3. Retail Shopping and Office Building Districts.—Treated wood-block pavements, the best grades of bituminous pavements on a Portland cement-concrete base. At the present time the only wood recommended for wood-block pavements is long-leaf yellow pine.

Class 4. Residential Districts in the City Proper.—Treated wood-block pavements, the best grade of bituminous pavements or Portland cement-concrete pavements, the choice to be determined by the intensity and character of the traffic.

Class 5. Suburb and Residential Districts.—Cheaper types of bituminous pavements, using old macadam surfaces for the base where suitable, or Portland cement-concrete pavements.

Class 6. Park Roads Carrying only Pleasure Traffic.—Bituminous pavements, using old macadam for the base where suitable, or Portland cement-concrete pavements.

Extra Cost of Reinstating Roads.—The Metropolitan Water Board, the General Post Office, and the Wimbledon Corporation have agreed to allow the Maldens and Coombe Urban District Council to increase by 25 per cent their charge for the reinstatement of roads and footways.

Seats for Wounded Soldiers.—The Highway Committee of the Sheffield Corporation have issued an appeal for the loan or gift of seats for the use of wounded soldiers. Up to September 14th approximately 100 seats had been given or lent for this purpose. They are placed in various parts of the city where soldiers gather, mostly in the central parts of the town. They have been found a great convenience to the men, and have caused little or no annoyance to the general public.

Universities and Engineering.—The Cheshire County Council Education Committee have made arrangements with the authorities of McGill University, Montreal, which will permit of young engineering students winning technological scholarships in Cheshire going to Montreal to have part of their three years' training at the McGill University. It is understood that the arrangement is reciprocal, and that McGill students will be accepted at English universities for a period of their training. The concessions are regarded with great interest in scholastic circles.

WATER PURIFICATION.

COPPER SULPHATE TREATMENT.

A successful campaign against tastes and odours due to organic growths in the water-supply of St. Paul, Minn., was conducted in 1915, on lines recommended the previous year by Mr. Allen Hazen, consulting engineer, New York City. The campaign, says *Engineering News*, was in direct charge of Mr. N. L. Huff, professor of botany, University of Minnesota, under Mr. G. O. House, general superintendent of the St. Paul Bureau of Water. The following information is taken from a paper by Professor Huff, read before the convention of the American Waterworks Association, in New York City, last June.

The water supply of St. Paul is taken from a series of lakes. A laboratory was established on the lower one, and a careful study made of the organisms in the lake before and after treatment with copper sulphate. The lake as a whole was treated three times, at a cost of $180 for material and $17·50 for labour each time. Special treatment of troublesome coves and shallows was also made at slight expense. The result of the treatment was a material reduction in the number of complaints of bad taste or odour from consumers.

The paper describes all the governing conditions and gives the mode and results of the treatment in detail. In conclusion, after naming the various classes of green and blue algæ, diatoms and protozoa found in the water during the campaign, Professor Huff says:

"With conditions under which above treatments were made, a treatment of one part of copper sulphate in 10,000,000 parts of water remains effective for about five weeks, after which time the organisms present, or many of them at least, seem to find conditions favourable for their growth and reproduction, and if the treatment is not repeated at this time they may increase again with remarkable rapidity.

"Where quiet shallow bays afford breeding places for numerous organisms, or where any one or more organisms become abundant in small or limited areas, local treatment or the application of small quantities of copper sulphate to the particular spot where the trouble is originating has been found very effective. If careful attention is given to such areas, and accumulations of organisms prevented here, the number of general treatments necessary to keep the lake clean for the entire season may be lowered, and the total cost of treatments materially reduced.

"For treatment of very shallow bays, flat muddy shores and small ponds the use of a hand pump such as is used for spraying trees is a practicable and economical means of distributing copper sulphate. In addition to spreading the solution in places inaccessible for a boat, this method has the advantage of leaving the water unrolled and gives the organism the full effect of the copper, much of which might otherwise be absorbed by mud and organic matter stirred up by a boat in such places."

Water Waste Prevention in Johannesburg.—A substantial reduction in the percentage of wastage of water in Johannesburg is reported by the town engineer, Mr. G. S. Burt Andrews, in his report for the year ended June 30, 1914. The quantity unaccounted for was 13·03 per cent, a decrease of 2·61 per cent on the previous year, and 5·70 per cent on the year 1911-12. This result has been brought about by careful supervision, a close examination of doubtful meters, and the taking out of defective mains.

A Treasure in the Trenches.—"A week ago," writes a corporal in the A.S.C.M.T., "I dropped my 'Swan' fountain pen near the trenches in the dark, and as it meant pretty certain sniping if I lit a match, I reluctantly had to abandon it. This morning I was passing that way again, and found my lost property 50 yds. from where I had missed it. Apparently a bursting shell had blown it down the road. I have had the pen in constant use ever since the early days of the war. That it stood the rough usage without ever failing me, and was as smooth in writing at the end as when first I had it, bears evidence of 'Swan' excellence and utility for soldiers at the Front." Thousands of "Swan" pens are being used by our men at the Front and in the Fleet, and, in truth, what more useful present could be sent to either soldier or sailor? Our readers would do well to ask the manufacturers, Mabie, Todd & Co., Limited, 79 and 80 High Holborn, London, W.C., for their free booklet giving full particulars.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

EAST MIDLAND DISTRICT MEETING.

District Chairman—Mr. E. G. Mawbey, M.Inst.C.E., Borough Engineer, Leicester.

An East Midland District Meeting will be held at Melton Mowbray to-morrow (Saturday).

Programme.

2.0 p.m.—Meet at Colles Hall, where the members will be received by the chairman of the urban district council, Councillor Sholto H. Sikes, Esq., J.P.
District business.
2.30 p.m.—Paper, entitled "The Municipal Works of Melton Mowbray," by Mr. Edmund Jeeves, surveyor to the urban district council, to be followed by discussion.
4.0 p.m.—Tea, by kind invitation of the chairman of the council.
4.30 p.m.—Walk to destructor pumping station.
5.0 p.m.—Walk to Sewage Disposal Works.
5.45 p.m.—Return to Melton by way of Cattle Market.
(The distance to be walked is about a mile each way.)

W. H. A. Court,
Hon. District Secretary, pro tem.

Borough Surveyor's Office,
Leicester.

NORTH-EASTERN DISTRICT MEETING.

District Chairman—Mr. J. P. Wakeford, M.Inst.C.E., City Engineer, Wakefield.

A North-Eastern District meeting is to be held at Wath-upon-Dearne on Saturday, September 30th.

Programme.

10.15 a.m.—Meet at waterworks pumping station, adjoining Wath-upon-Dearne (G.C.Rly.) Station, and five minutes' walk from Wath-upon-Dearne Midland Station. Proceed to inspect the plant.
10.30 a.m.—Walk alongside the G.C. Railway to the new sewage disposal scheme in course of construction.
10.45 a.m.—Proceed to inspect the sewage disposal works.
11.30 a.m.—Proceed by motor 'buses from near Messrs. Stanley's oil works at Common-lane, along the main road *viâ* Barnsley-road and Brampton to Wath Wood reservoirs to inspect works there recently carried out. *En route* inspections will be made of the public baths, mortuary, sections of Tarmac roads, and private street works.
12.45 p.m.—Leave reservoirs by motor 'bus.
1 p.m.—Lunch at the Red Lion Hotel.
2.15 p.m.—Proceed to town hall, where the institution will be welcomed by the chairman of the urban district council, Councillor Chas. Adkins, J.P.
Business:
(1) Minutes of last meeting.
(2) Correspondence.
(3) Election of executive committee.
(4) Any other business.
(5) Orphan Fund and support from N.E. District.
(6) Paper on "Notes of Municipal Works and Statistics in the Urban District of Wath-upon-Dearne," by Mr. J. H. Drew, M.Inst.C.E.I., M.R.San.I. (Member), engineer and surveyor to the urban district council, Wath-upon-Dearne, will be discussed.
5 p.m.—Tea at the Red Lion Hotel, by kind invitation of County Councillor Richard Payne, member of the Wath-upon-Dearne Urban District Council.

EASTERN SUB-DISTRICT MEETING.

District Chairman—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer, Middlesex.

An Eastern Sub-District Meeting (Norfolk, Suffolk and Cambridge) will be held at Stowmarket on Saturday, September 30th.

PROGRAMME.

11.30 a.m. Meet at the Stow Board Room (Market-place), when Mr. A. E. Ellis, J.P., chairman of the Stowmarket Urban District Council, also chairman of the Joint Sewerage Committee, will receive the members.

Read minutes of previous meeting.

Paper on "Municipal Engineering Work at Stowmarket," by Mr. Gerald W. Lingwood. (Copies of paper will be sent to members who signify intention of attending.)

1.0 p.m.—Lunch at the Fox Hotel. (Tickets, 2s. 6d. each.)

2.15 p.m.—Inspect sewage works, main sewage pumping station, waterworks electric light works, Combs electric sewage pumping station and Combs waterworks.

4.30 p.m.—Afternoon tea at the Fox Hotel, by invitation of Mr. G. W. Lingwood.

JOHN R. MEAD,
Hon. Sub-District Secretary.

Ipswich.

INSTITUTION OF MUNICIPAL ENGINEERS.

GLOUCESTER MEETING.

A meeting of the Western and South Wales Districts of the institution will be held at the New Inn, Gloucester, on Thursday, September 28th, at three o'clock.

AGENDA.

Election of district chairman.
Election of hon. district secretary.
Programme of meetings and visits for the year 1917.
Any other business.

JOHN BROOK,
Hon. District Secretary.

Salaries in New South Wales. A Sydney message states that Mr. Justice Heydon, in the Industrial Court, has dismissed the application of the Professional Officers' Association of New South Wales for the constitution of a salaries board to regulate the pay of civil engineers, architects, surveyors, barristers, doctors, solicitors, and other professional men in the employment of the Sydney City Council and other municipal councils.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR.—September 25th.—Warblington Urban District Council. £160. Mr. W. L. Cooper, clerk, 14 Queen-street, Emsworth.

GASWORKS FOREMAN.—September 28th.—Wombwell Urban District Council. £2 per week, plus 4s. war bonus, with house, coal and gas. Mr. Percy M. Walker, clerk, Town Hall, Wombwell.

SURVEYOR AND INSPECTOR OF NUISANCES.—September 30th.—Barton-on-Humber Urban District Council. Mr. G. H. Nowell, clerk, Barton-on-Humber, Lincs.

TEMPORARY ENGINEERING ASSISTANT.—September 30th.—Corporation of Bedford. Mr. N. Green-Imeldi, borough engineer and surveyor, Town Hall, Bedford.

WATER INSPECTOR.—September 30th.—Corporation of Bedford. 40s. per week, with 5s. 6d. war bonus. Mr. N. Green-Imeldi, water engineer, Town Hall, Bedford.

SURVEYOR AND INSPECTOR.—October 2nd.—Llandilo Urban District Council. £80 per annum.—Mr. R. Shipley Lewis, clerk, Llandilo.

TEMPORARY INSPECTOR OF NUISANCES.—October 6th. — Chesterfield Rural District Council. £130-£140 per annum.—Mr. R. F. Hartwright, clerk, Union Offices, Chesterfield.

TEMPORARY CLERK.—Somerset County Council. £110 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY DIVISIONAL SURVEYOR.—Somerset County Council. £115 per annum. Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

HEMEL HEMPSTEAD.—September 27th.—For repairs and painting at the sewage pumping station, for the corporation.—Mr. W. R. Locke, borough surveyor and waterworks engineer, Town Hall.

Engineering: Iron and Steel.

SELBY.—September 26th.—For providing and driving piles and fixing waling, for the Selby Dam Drainage Commissioners.—The Surveyor, Lendal-chambers, York.

MANCHESTER.—September 27th.—For the supply of bolts, nuts and rivets, and offers for clean waste-paper, for the Cleansing Committee.—Mr. R. Williamson, superintendent, Cleansing Department, Town Hall.

ST. AUSTELL.—September 28th.—For the supply of about 1,760 yards of 5-in. or 6-in. cast-iron pipes, spigot and faucet joints, in 9-ft. lengths, for the rural district council.—Mr. J. Stephens, clerk, St. Austell.

MELBOURNE.—September 29th.—For the supply of cable, for the city council.—Messrs. McIlwraith, McEacharn & Co., Ppty., Limited, Billiter-square Buildings, London, E.C.

GISBORNE (New Zealand).—October 2nd.—For supplying and erecting a cooling tower for cooling the circulating water used for condensing 9,000 lb. of steam per hour, for the borough council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

ARGENTINE.—October 13th.—For the supply of 27,807 metric tons of light pipes and 32,164 metric tons of heavy pipes of cast-iron, for the Ministry of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Mechanically-Propelled Vehicles.

DUBLIN.—September 26th. For the supply of a motor van, for the corporation. The Secretary, Markets Committee, City Hall.

BEDDINGTON AND WALLINGTON.—October 2nd. —For the supply of one 3-ton general-utility steam wagon, fitted with rubber tyres, for highway work, and one 3-ton steam wagon for the collection of refuse, for the urban district council.—Mr. S. F. R. Carter, engineer and surveyor, Wallington, Surrey.

Roads.

SOUTH MIMMS.—September 26th.—For the supply of Leicestershire or other broken granite, chippings, blast-furnace slag, gravel, hoggin or building shingle, and 6,000 gallons of distilled tar, for the rural district council.—The Surveyor, Potters Bar.

LEATHERHEAD.—September 26th.—For the supply of broken granite, team labour, disinfectants, brooms, and steam rolling and scarifying, for the urban district council.—Mr. S. R. Drake, surveyor, Leatherhead.

HOLLINGBOURN.—September 27th.—For the supply of steam rollers, for the rural district council.—Mr. H. J. Bracher, clerk, 33 Earl-street, Maidstone.

SUNDERLAND.—September 30th.—Quotations are invited by the rural district council for the purchase of a second-hand 15-ton road roller (Aveling & Porter), with Morris' patent detachable scarifier.—Mr. J. C. Wilson, clerk, 17 John-street, Sunderland.

SEAFORD.—September 30th.—For the supply of 500 tons of 1½-in. broken granite, for the urban district council.—Mr. W. H. Pawson, clerk, 3 Clinton-place, Seaford.

SANDGATE.—October 2nd. For the supply of 600 tons of Guernsey, Leicester, or Cornish granite, or Cherbourg quartzite, evenly broken to a 1½-in. gauge, and 600 tons of Guernsey, Leicester or Cornish granite, or Cherbourg quartzite chippings, evenly graded to ½-in. gauge, and free from dust, for the urban district council.—Mr. D. V. Howard, surveyor, Council Offices.

HOVE.—October 4th.—For the supply of broken stone, for the corporation.—Borough Surveyor, Town Hall.

BEACONSFIELD.—October 25th.—For the supply of 1,000 tons of 2½-in. and 1½-in. broken granite, for the urban district council.—Mr. H. T. Smith, surveyor, Council Hall, Beaconsfield.

Sanitary.

DUNDEE.—September 25th.—For the supply of disinfectants and soap, for the corporation.—Dr. C. Templeman, medical officer of health, West Bell-street, Dundee.

SOUTHWICK.—September 25th.—For the collection of house refuse, for the urban district council.—Mr. E. Webley, Town Hall.

CHERITON.—September 25th.—For the collection and removal of house and other refuse, for the urban district council.—Mr. A. Atkinson, jun., acting clerk, Public Offices, Cheriton.

HOLLINGBOURN.—September 27th.—For certain works at the sewage works, for the rural district council.—Mr. H. J. Bracher, clerk, 33 Earl-street, Maidstone.

SKIPTON.—September 30th.—For the construction of 760 lineal yards of 9-in. sewer and manholes, for the rural district council.—Mr. A. Rodwell, 16 Gargrave-road, Skipton.

BLEAN.—October 9th.—For emptying cesspools and removing house refuse, for the rural district council.—Mr. R. Miles, Eddington, near Herne Bay.

Stores.

HENDON.—September 28th.—For the supply of broken granite, tar-paving material, tarviated granite, granite chippings and gravel, brooms, shovels, forks, and carting materials, for the rural district council.—Mr. J. A. Webb, Great Stanmore, Middlesex.

Miscellaneous.

TILBURY.—October 2nd.—The urban district council invite tenders from recognised refuse destructor makers for the construction of a destructor and auxiliary plant.—Mr. S. A. Hill-Willis, engineer and surveyor, Council Offices, Dock-road, Tilbury.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

SEPTEMBER.

23.—Institution of Municipal and County Engineers: East Midland District Meeting at Melton Mowbray.

28.—Institution of Municipal Engineers: Meeting of Western and South Wales Districts at Gloucester.

30.—Institution of Municipal and County Engineers: Eastern Sub-District Meeting (Suffolk, Norfolk, and Cambridge) at Stowmarket

30.—Institution of Municipal and County Engineers: North-Eastern District Meeting at Wath-on-Dearne.

OCTOBER.

6.—Municipal Waterworks Association: Annual Meeting, Metropolitan Water Board Offices, Savoy-court, London, W.C. 2 p.m.

7.—Institution of Municipal and County Engineers: Meeting at Watford.

APPOINTMENTS OPEN.

BARTON-ON-HUMBER URBAN DISTRICT COUNCIL.

SURVEYOR AND INSPECTOR OF NUISANCES.

The above Council are prepared to receive applications for the post of Temporary Surveyor and Inspector of Nuisances. Population about 6,000.

The person appointed must be fully qualified, and be ineligible for the Army.

The appointment will be made for the duration of the war only, or until the return of the Council's permanent Surveyor, and will be subject to the sanction of the Local Government Board.

Applications, in own handwriting, stating fully age, qualifications, salary required, and when can commence duties, with copies of not more than three recent testimonials, to be sent to the undersigned so as to reach him not later than the 30th September, 1916.

Canvassing will be a disqualification.

G. H. NOWELL,
Clerk to the Council.

Barton-on-Humber,
Lincolnshire.
September 12, 1916. (3,093)

CHESTERFIELD RURAL DISTRICT COUNCIL.

TEMPORARY APPOINTMENT OF INSPECTOR OF NUISANCES.

The above named Council invite applications from persons, ineligible for military service, for the appointment of Inspector of Nuisances for the Eckington District, which comprises the Parishes of Beighton, Coal Aston, Eckington and Killamarsh. Area 13,459 acres. Population (1911 census), 22,117.

Salary £130, rising by £5 per annum to £140 a year.

The appointment will be subject to the approval of the Local Government Board, and will be made for the duration of the war only.

The person appointed must hold the Certificate of the Royal Sanitary Institute, and will be required to fulfil all the prescribed duties of Inspector of Nuisances under the Public Health Acts and Regulations made thereunder; to assist in the work of the Council under the Housing, Town Planning, &c., Act, 1909, and at all times to carry out the lawful orders and directions of the Council. The appointment will be made on the understanding that the officer will reside at Eckington, and will devote the whole of his time to the duties of his office.

Applications, stating age, experience and qualifications, must reach me by Friday, the 6th day of October, 1916.

(By order of the Council)
R. F. HARTWRIGHT,
Clerk.

Union Offices,
Chesterfield.
September 18, 1916. (3,103)

BOROUGH OF BEDFORD.

TEMPORARY ENGINEERING ASSISTANT.

Wanted, in the Borough Engineer and Surveyor's Office, a Temporary Engineering Assistant (ineligible for military service) for the duration of the war.

Applications, in candidate's own handwriting, stating age and salary required, and giving full particulars as to experience, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, September 30th.

Canvassing will disqualify.

N. GREENSHIELDS, Assoc.M.Inst.C.E.,
Borough Engineer and Surveyor.

Borough Engineer and Surveyor's Office,
Town Hall, Bedford.
September 12, 1916. (3,097)

BOROUGH OF BEDFORD.

WATER INSPECTOR.

Wanted, in the Waterworks Engineer's Department, an Assistant Water Inspector (ineligible for military service).

Candidates must be qualified plumbers, capable of laying and repairing water mains, services, fittings, &c., and experienced in the management of men.

Wages 40s. per week, in addition to which a temporary war bonus of 5s. 6d. per week will be paid during the period of the war.

Applications, in candidate's own handwriting, stating age and giving full particulars of experience, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, September 30th.

Canvassing will disqualify.

N. GREENSHIELDS, Assoc.M.Inst.C.E.,
Waterworks Engineer.

Waterworks Engineer's Office,
Town Hall, Bedford.
September 12, 1916. (3,096)

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Divisional Surveyor, to reside in Long Ashton. Ineligible for the Army. Applicants must be fully qualified, experienced in road making, manufacture of tar-macadam, and control of plant for same, surface tarring, &c. Able to control and supervise roadmen and keep detailed accounts, prepare estimates, &c. Salary to commence £115 per annum, with £30 per annum for upkeep of a motor cycle. Applications, stating age, experience, and accompanied by testimonials, to be sent to the undersigned.

GORDON R. FOLLAND,
Acting County Surveyor.

Wells, Somerset. (3,101)

The Surveyor

And Municipal and County Engineer.

Vol. L. SEPTEMBER 29, 1916. No. 1,289.

Minutes of Proceedings.

The Silence of the Engineer.

For some time past—and a long time before the war conditions became an excuse—we have drawn attention to the fact that there is a lamentable secretiveness in this country with regard to the work of the engineer. A mass of information has been gathered, great lessons have been learned and great things done, and the records are hidden by secretive persons and authorities who are mean enough to ask why others should benefit by their work. The result is public ignorance. It is true that the greatest men give the records of their life's work to the world often without any reward. But such is not the general rule; either we as a nation do not possess the gift of conveying our ideas to each other in written words or we have set up an utterly false idea of the merit of silence. One has only to read the pages of any technical civil engineering journal at the present time to find that, while it is full of well written and very interesting records of American practice, work often of far greater merit and of special interest in this country is not mentioned. One of the most striking instances of the lack of information is in the case of deep borings. As far as can be gathered, most of those who sink borings in great numbers gather their information and keep it to themselves. If one regards these persons merely as tradesmen such reticence is permissible; if, however, they wish to rank as engineers such reticence is not justified. The real reason is not far to seek. There are too many failures in this much-advertised method of obtaining water for any one interested to dare to publish a full record. In this case silence is golden to certain persons, and will remain so till the public are educated up to the point of knowing that a deep boring is always a risky undertaking. The engineers have it in their hands to educate the public, and this cannot be done by a policy of silence. In the first place it is absolutely essential that the newest and latest works and methods should be freely described and discussed. We also need free and open criticism of bad work and policy. It is useless waiting for the Government or Government departments to take the lead. Government departments are advised by men of moderate attainments, who, having fallen out of the ranks of the ordinary professional workers, are apt to be behind the times. Further, the chief object of such a department is to be on the safe side, and above all things to avoid laying itself open to criticism. They will not originate anything that is not their work. They can apply the brake, but others must apply the motive power.

There is not the slightest doubt that a great deal of work in this country, and particularly the work of local authorities, is very badly done by incompetent persons. Men are placed in engineers' positions who are so ill-paid and so badly treated that it is impossible for them to carry out work properly. Further, no properly qualified engineer will work for the salary offered or submit to the treatment. It is equally in the interest of the profession and of the public to deal with such cases, and by criticising the methods adopted, proving the waste of money, and by forcibly objecting to engineers' work being handled by incompetent persons and interfered with by ignorant councillors. Also we should try to render the attitude of such local authorities impossible. It is the silence of the engineer and the consequent deep ignorance of the public which makes bad work possible, and which consequently lowers the position of the district surveyor and the engineering profession as a whole. The public have been educated to the point of knowing that a medical officer must be a properly qualified man. Why should they not be similarly educated in the knowledge that an engineer's work is quite as important, and that he must be properly qualified, properly paid, and properly treated? The people of England are not fools, and if they can once be educated to the extent of understanding the folly of allowing their money to be wasted by incompetent persons they will not be slow to put an end to the system. Further, these are times when the public show a keen interest in all engineering matters, and full descriptions of the newest and best methods will be readily comprehended. It is therefore the duty of the engineer to see that the records and results of his work are brought forward prominently, that the errors of the past are made clear, that popular belief in old and discredited systems is removed, and that the true value of the qualified engineer is understood. Moreover, the idea that an engineer is qualified for special work solely by some general examination must not be encouraged, for this will

merely lead to an educated person of incompetence being placed in a position in which he will bring discredit on to the profession.

It cannot be too well understood that an engineer is qualified by his education, training, and experience for the special work which he undertakes to do. These and nothing else are his qualifications, and they can always be ascertained. If you want a man to make aeroplanes, see that he has been trained for that work and that he has actually made aeroplanes. If you want a man to act as a municipal engineer, see that he has also been trained for that work, and that he has actually fulfilled the duties satisfactorily. No other qualification can exist. Let the public learn these facts, and let engineers give support to the efforts now being made to enable them to do so; it will give an increased vitality to the profession, it will give fresh energy to professional meetings, it will give the engineer his proper position, and it will remove the dense public ignorance which is the cause of trouble. All this and more can be done, but it will not be done by silence.

* * *

Tramway Problems.

The fifteenth annual conference of the Municipal Tramways Association, which was held in London at the end of last week, afforded an opportunity to Mr. J. M. McElroy, the general manager of the Manchester Corporation Tramways, to read a paper in which he discussed some of the more important problems of modern tramway traffic in large cities. These problems arise principally in two directions. First, the constant tendency of the population to move from the centre to outer zones has a very direct relationship to cheap passenger transport facilities. Indeed, it may be said that town planning schemes and the making of provision for future passenger transport requirements are really part and parcel of the same problem, and should be considered together. The second group of problems arises from the fact that every extension of the means of transit into the outer zones adds to the difficulties of handling the traffic at the centre. This central congestion can only be met by the provision of overhead or underground railways—which do not come within the sphere of the tramway manager or engineer—or by shallow subways into which surface cars can be run. The last mentioned are generally impracticable owing to the enormous capital expenditure involved. It has been said, indeed, that underground lines of any description can only be justified by a dense traffic demanding the operation of high-speed trains run at very close intervals.

In studying the problem in Manchester—where several of the arterial routes approaching the centre of the city have practically reached the saturation point—Mr. McElroy came to the conclusion, after careful consideration, that the proper course for the corporation to pursue to meet the constantly growing requirements was—before attempting to provide underground facilities, the cost of which is so enormous—to improve and make more efficient the existing surface lines by opening out parallel routes, by forming new streets and widening others at considerable cost, and also by adopting tramway terminals near the heart of the city, the latter being necessary on account of the narrowness and bad lay-out of the central streets. Mr. McElroy also had some very pertinent remarks to make as to the relative merits of tramcars and motor 'buses. In the past this important question has too frequently been discussed from an abstract point of view and without reference to the particular purpose for which the vehicles are intended to be used. The truth is that each type of vehicle has its peculiar advantages, and in the future each will be utilised for handling that class of traffic for which it is best suited. The tramcar, on account of its greater seating capacity and its ability to cope with traffic of a widely fluctuating character, will be utilised where heavy peak loads have to be catered for. On the other hand, where the volume of traffic is not great, or where there is a steady traffic flow throughout the day, motor 'buses will probably prove to be the more suitable vehicles. In some instances it may be found to be advantageous to run the two types of vehicle along the same routes, not in indiscriminate competition and without direct reference to the requirements of the public as is the case in London to-day, but by a scientific adjustment throughout the day of the type of vehicle to the demand.

* * *

Cardigan Rural Surveyor's Salary.

The surveyor to the Cardigan Rural District Council, being we trust a grateful man, will doubtless all the more manifest this quality as the outcome of a discussion at a recent meeting of the council. When it is stated that, as a result of these proceedings, the surveyor had his salary increased from 21s. to 25s. per week (including 1s. war bonus) little more need be said to prove the progressive and generous spirit actuating the public actions of Cardigan's rural councillors. The figures quoted stand for a definite and tangible advance, and who shall say that this does not imply progress? They also postulate something like a pathetic concern (of which the 1s. war bonus may be accepted as an incidental example) of the council for the worldly welfare of their officer, and who shall deny that is not distinctly suggestive of generosity? Little need have been added to the bald record of fact, but for the views to which one or two speakers gave expression in the course of the discussion. It should be explained that the proposer of the increase laid down the condition that it was to be granted if the surveyor devoted six instead of five days a week to the service of the council, otherwise it was to be conceded upon the grounds that he was entitled to it, that the increased cost of living affected him as much as anyone else, and also that he had done his utmost to reduce the cost of the maintenance and repair of the highways. As against these reasons for the proposition it was urged that to increase the surveyor's salary would be a "wastage," especially as "any man could do the work of a highway surveyor;" and that an increase of 4s. per week was excessive—was, so to speak, a piece of downright extravagance and prodigality. As showing how perilously near to losing his increase the surveyor was, it may be stated that it was only carried by a majority of one, a fact which will doubtless make him chary of testing the feeling of the council for a long while to come. Seriously, however, is it not a scandal that public officials performing duties of recognised responsibility and importance should be subject to such conditions of service as this? While it may be pitiful that such a salary as 21s. per week should be accepted for the discharge of professional work, it is almost despairing to find that there are still existing public bodies which offer such a paltry pittance to any official, but more particularly to a surveyor. A remedy must be found for such an intolerable state of things.

* * *

Progress at Melton Mowbray.

The paper read by Mr. Edmund Jeeves, the surveyor to the Melton Mowbray Urban District Council, at the East Midland District meeting of the Institution of Municipal and County Engineers held in that town on Saturday last, shows that the district is one in which the local authority has always been alive to the importance of progress in sanitary administration.

Melton Mowbray is an ancient market town, and in the earlier half of the nineteenth century it was, from the sanitary point of view, apparently no better than other similar towns. For example, prior to the year 1860 there were no sewers, the whole of the drainage being conveyed to the river in open watercourses. In that year the first drainage scheme was carried out, and this was followed in 1875 by a scheme designed by Mr. Baldwin Latham, and in 1896 and 1907 by schemes for the improvement of the outfall works. Again, with regard to refuse disposal, this was for many years effected by the simple process of tipping into an old brick-yard at one end of the town, but upon the nuisance from this primitive method becoming more apparent, arrangements were made for the erection of a destructor, which started to work in February, 1915. Similar progress has been made with regard to water supply. Prior to 1886 the supply was derived from local wells, which gradually became unfit for use owing to pollution; accordingly in that year a gravitation scheme was carried out. An underground spring was tapped about 3 miles from the town, an adit was constructed to hold 100,000 gallons, which was then a day's supply, and cast-iron mains were laid. Again, it appears that in the old days the cattle markets were held in the streets, but this became such a nuisance that in 1869 a special Act of Parliament was obtained authorising the construction of proper market buildings and the levying of tolls. Altogether, Mr. Jeeves' paper contained a record of excellent progress, upon which the council and its expert advisers are to be congratulated.

* * *

Housing after the War.

In our last issue we referred to the deputation which recently waited upon Mr. Walter Long, the President of the Local Government Board, in order to bring to the notice of the Government a series of resolutions regarding the problem of housing after the war, which were adopted some time ago by a conference on the subject under the auspices of the National Housing and Town Planning Council. The reply of the President was eminently satisfactory, in that it contained an official recognition of the fact that a solution of the housing question lies at the root of all social reforms, and a definite promise to lay before his colleagues in the Government the case for a grant-in-aid on an adequate scale. When the war is over there is certain to be the keenest competition between the advocates of various kinds of social reform, and there is some danger that the vital importance of housing may be lost sight of unless those who are alive to the real circumstances take every step to keep it in the foreground. Curiously enough, the war has at once caused a practical cessation of cottage building, and created a new and powerful reason for improved housing accommodation. As Mr. Long said, it would indeed be a crime if, upon returning from the sufferings and discomforts of trench warfare, our heroes are compelled, owing to lack of foresight on the part of those who have remained at home, to come back to homes that are in many cases barely fit for human habitation at all. We sincerely hope that the good words of Mr. Long may be speedily translated into action by the Government.

* * *

Plane Trees: A Superstition.

The old superstition that the presence of plane trees in the vicinity of dwelling-houses is conducive to cancer was recently revived by a resident of Claygate, Surrey, who wrote to the Esher and the Dittons Council complaining that a plane tree on the highway near her house not only obstructed the access of light and air, but also might lead to the onset of the disease named. Local investigation certainly revealed a curious coincidence, in that it was discovered that three people living in the road in question had died from cancer, and there was a plane tree outside each house. But the medical officer of health pointed out that this could be no more than a coincidence, because plane trees are probably the most commonly used variety for planting in streets, and if the alleged danger were a real one, some districts that are quite immune would be devastated by cancer. The plane tree, which flourishes so well in urban surroundings, has, if our memory serves us, also been attacked because it is alleged that it sheds spicules which are conducive to nasal irritation and thus cause a kind of hay fever. Nevertheless it retains its popularity. At all events the Esher and the Dittons Council do not believe in the cancer superstition, because, although the offending tree is to be pruned so that it does not obstruct light and air, it is not to be removed, in spite of the lady resident's nervousness.

* * *

Water Waste.

For some time past we have been emphasising the need for securing a drastic reduction in the general waste of water which takes place throughout the country. The one disadvantage of charging for water by a rate and not according to the amount consumed lies in the temptation to careless and reckless waste which inevitably follows upon the knowledge that extravagance does not affect the amount of the quarterly bill. We are now glad to find that our efforts have not been wholly in vain. At a recent meeting of the Ossett Water Committee the engineer, in dealing with the question of waste, quoted from our columns in his report. From a report of the meeting we observe that he read an extract from The Surveyor emphasising the national importance of economy in the use of water at a time when every penny saved means so much to the country. At the following council meeting the chairman of the committee asked the ratepayers to exercise economy in consumption, and to notify any wastage, particularly owing to defective fittings. The public do not appear to realise that every gallon of water used has to be paid for, and other local authorities would do well to follow the example of the Ossett Town Council in officially calling attention to the matter.

* * *

Women's Work in War Time.

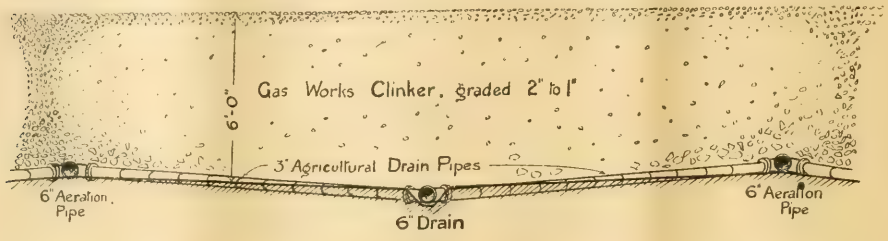
The fact that an application for membership by a woman has been received by the Institute of Metals naturally leads one to reflect on the possibility of similar applications being made to other engineering societies. Hitherto the engineering profession has not, so far as we are aware, attracted women aspirants, but in these days it is well within the bounds of possibility that this may be changed. We do not remember that there is anything in the constitutions of the leading institutions which would preclude them from admitting women to membership if they were disposed to do so. The Institution of Municipal and County Engineers has as yet no women members, but in Mrs. Robinson, who has been appointed acting secretary during her husband's absence on active service with the H.A.C., they have the distinction of being the first engineering institution to have a woman acting in this capacity. Like her husband, Mrs. Robinson has considerable scientific attainments, and holds the degree of Bachelor of Science in the University of London. The members generally will join in wishing her success in the work she has so pluckily undertaken, and a speedy and safe return to duty of Mr. Robinson.

B*

Economical Sewage Filter-Bed Construction.

The percolating filter-bed is now a very usual feature in a sewage disposal scheme, and where adopted is sure to be responsible for a notable proportion of the cost of the scheme. It is not at all a costly item per unit of area, but as it is only by the use of ample filter area that a satisfactory effluent can be obtained, the aggregate cost is considerable.

Any method, therefore, of reducing the cost of the construction of such beds is worthy of close consideration, for a small saving on each square yard will mean an appreciable reduction of the total cost.



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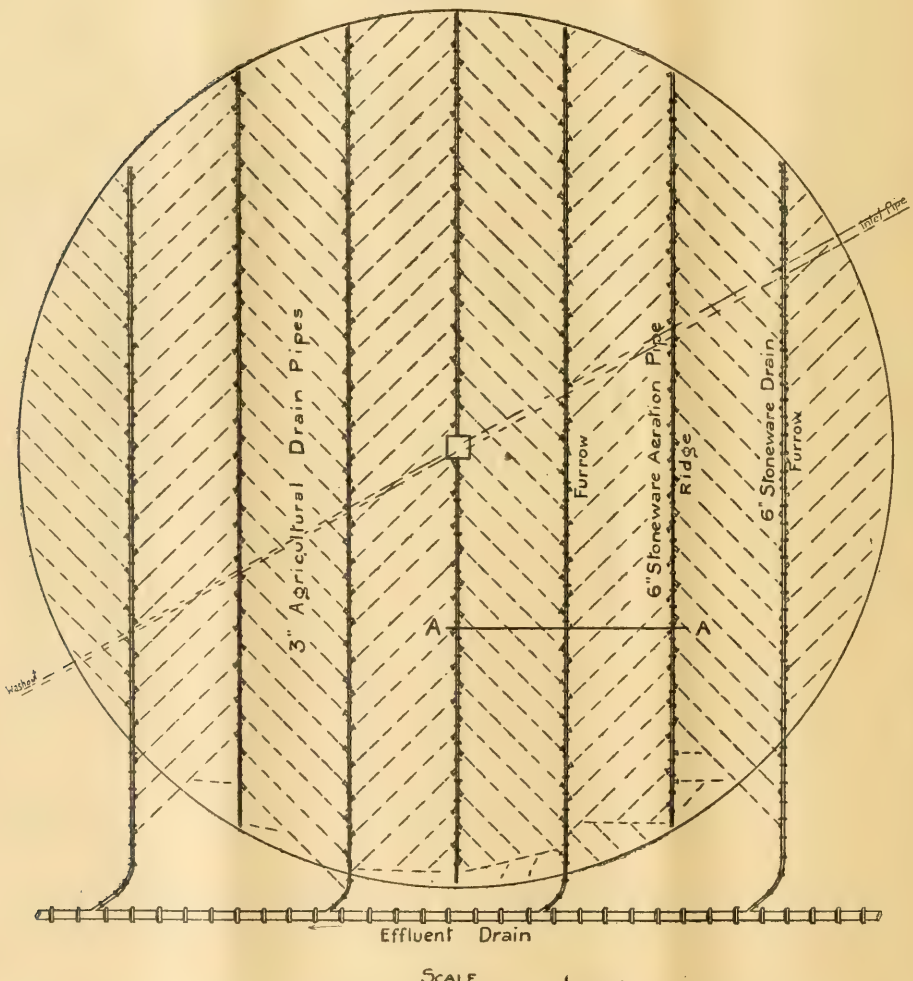


Plan of Drains.

PERCOLATING FILTER, LUTON.

Yet it would be very false economy to reduce the cost of the filter if in so doing the efficiency of the bed is impaired or its effective life shortened. If the effluent obtained is not satisfactory it is no consolation that the beds were cheap; while to have to rewash the filtering medium at the end of every five, or even ten, years is to be saddled with a heavy maintenance cost, as well as to be in constant risk from an effluent of varying quality. Cheapness is not economy if it reduces efficiency or shortens life.

The chief item of cost, of course, is the filtering medium, and here local conditions are the predominating factor. What is cheap at one place is expensive at another, and each locality must make its own selection by the light of local knowledge, assisted by reliable information as to the relative merits of the types of material available for the purpose in view.

The next item in the scale of cost is what may be called the constructional works—viz., the concrete floor, the false-tile floor, and the walling. In some instances these works are pushed to considerable elaboration, and represent a heavy proportion of the total cost of the filter-bed. It is here, if anywhere, that a saving is to be effected, and the only sure guide of what may or may not be reduced or omitted is experience.

In this connection a recent report by the borough engineer of Luton upon the filter-beds installed there some years ago is of interest. These filter-beds were constructed, most of them, in 1910-11, as part of the scheme then carried out for dealing with the whole of the sewage of the borough, the remainder having been added since 1914 to meet the requirements of a rapidly growing population. The beds are all similar in construction. They are circular, 100 ft. in diameter, with a depth of filtering material of 6 ft., except in three cases, where the depth is only 4 ft. There is no concrete floor to the beds, the filtering medium being placed immediately upon the consolidated earth. The subsoil is chalk, and this was thoroughly rolled with a steam roller before the construction was commenced. The area of the bed was then shaped into a series of parallel ridges and furrows, the ridges being 25 ft. apart, and having an elevation of 6 in. above the furrows, both furrows and ridges having an inclination of 1 in 200 towards the effluent drain, which passes the bed at right-angles to them. A shallow grip is then cut up each furrow, and a 6-in. stoneware drain is laid along it, bedded in large clinker. Every pipe of this drain is a junction pipe, and the junctions are alternately right and left hand. From each junction a 3-in. agricultural drain pipe, also laid in a grip and packed in clinker, runs up the slope in a straight line from the junction to a 6-in. stoneware drain on the ridge, which is similar in all respects to the one in the furrow, except that its junctions point in a reverse direction and that it is not sunk in a grip. None of the pipes are jointed. The floor of the bed is thus provided with a system of subsoil drains. The drains from the furrows discharge into the main effluent drain, and those from the ridges are turned up at each end and open through the wall of the filter-bed to the air.

Upon the floor thus prepared the filtering material—in this case it consisted of London gasworks clinker—is laid, grading and placing in position being done simultaneously. The wall of the bed is formed simply of large pieces of the material laid as rough walling.

From these particulars it will be seen that a cheaper form of construction than that adopted could not well be devised. The report referred to above appears to answer the question whether this construction is justified by results. It states:—

"No. 1 filter-bed was opened and examined in the summer of 1913 after a life of three years, and a report upon its condition was then presented. This year (1916), after being continuously at work for six years, the bed has again been opened up and carefully inspected. The drains were found to be perfectly clear and free from any trace of solid deposit. The filtering material in the top half of the bed was quite clear and contained no deposit at all. Below this there was a small quantity of deposit to be found on almost every piece of clinker, but there was no indication of the deposit being anywhere in such quantity as to approach a condition of local silting up. Compared with the condition found on examination three years ago, there can be no question that at present the bed is cleaner than it was then. This would indicate that the deposit present is one which is continuously being washed away and continually added to in the working of the filter, and is the normal and natural state of the bed, and in no way indicative of deterioration. It is worthy of note that the particular bed examined has been in continuous use during the past twelve months, without even the briefest period of rest, but has worked night and day, seven days a week, at full capacity. . . .

"As you are aware, the quality of the effluent obtained has always been of the highest, and has satisfied the Lee Conservancy.

"The conclusion arrived at is that the bed is quite self-cleansing, and will continue to give efficient service for an indefinite period."

By the courtesy of Mr. J. W. Tomlinson, the borough engineer of Luton, we are able to reproduce a drawing indicating the construction of these filter-beds. We understand there are twenty of them in use at Luton, and it will be evident that the saving secured by omitting the usual brick walling, false and concrete floors must have been very considerable, and, apparently, so far as results go up to date (and six years is a fair period for discovering defects), the filters are as satisfactory as any filters, however constructed, could be.

THE MAGIC OF SEWAGE DISPOSAL.

HOW THE BACTERIOLOGICAL TREATMENT WAS DISCOVERED.

In his recently-published book, "Forty Years at the Bar," Mr. Balfour Browne gives an interesting explanation of how the bacteriological treatment of sewage was discovered.

"People who adopted sewage farms with systems of broad irrigation or intermittent downward filtration were," says the famous K.C., "really cleverer than they knew. The Rivers Pollution Commission in 1870 recognised that purification of sewage did take place by passing it through the pores of the soil, or, as it was thought, by filtration. But no one knew how the rapid transformation of the ammonia of sewage into nitrates by passing the sewage through a few feet of soil took place until two French chemists, MM. Schloesing and Muentz, in 1877, made some experiments with some earth from the Paris sewage farm. They treated their slab of earth with sewage and found that purification took place. Then they submitted the slab of earth to the fumes of chloroform, arguing that if the process of purification was filtration, or merely mechanical, the chloroform could make no difference, but if the purification was a vital process, carried out by means of living organisms, then the chloroform would make all the difference. And it did. After the earth had been submitted to the sleepy fumes the sewage went through the pores of the soil unchanged, for all the bacteria had been put to sleep, and it was only after they recovered from the chloroform that they recommenced their work of disposing of the sewage."

Mr. Balfour Browne suggests that but for the infinite labours of these small lives—more industrious and even more useful than Dr. Watts' "busy bee"—the world would long ago have been nothing but a planet of manure, a dung-heap or a cesspool.

"In the Manchester case," he proceeds, "we learned to distinguish between two different classes of bacteria which are both required to carry out the complicated process of purification. One of these works in the absence of air (very like counsel and witnesses in committee-rooms of the House), and these are known as anærobic bacteria; and the other to which the presence of air is essential, and these are called aërobic bacteria. Those that work without air break down the complex organic compounds present in sewage, while the completion of the work is left to those germs which insist upon ventilation. In Nature, of course, these two classes work side by side. In the sewage works they are separated, and the one set works in its laboratory called the septic tank, and the other in contact or double-contact beds of slag or clinkers, or under sprinklers which supply the sewage which has been prepared for them; and by this means a pure, almost pellucid liquid is produced which is incapable of putrefaction, and can be turned into rivers or even more sluggish waters with impunity. This is the magic of sewage disposal, and the wizards are these small bacteria."

C

The Use of Motor Vehicles in Municipal Work.

MECHANICAL *v.* HORSE TRACTION.—(*Conclusion.*)

By H. SHAW, M.INST.C.E., Engineer and Surveyor to the Ilford Urban District Council.

[In the following exhaustive report, prepared for the information of the Works Committee of his council, Mr. Shaw presents a mass of valuable facts and figures derived from the experience of various municipalities, and from his own knowledge, as to the advantages and disadvantages of mechanical versus horse traction, and discusses in detail each method of propulsion in order to enable the committee to decide whether the council's work can be carried out to greater advantage by the substitution of horse labour by mechanical traction. The first portion of the report appeared in our issues of the 15th and 22nd inst.]

At the present time the council own water vans having a capacity of 350 gallons.

The watering area is divided into districts, each with a street mileage of about 2½ miles. When the weather is fine each road is watered twice a day, therefore each van waters 5 miles of roads per day.

A load of water covers 530 yds. lin. measurement, so there are practically seventeen fillings required.

This work by horse labour costs 12s. per day, in addition to which there are the capital cost of the vans, depreciation and maintenance.

Motor watering tanks have capacities from 750 to 1,000 gallons, and in my opinion about four times more work would be carried out by these—that is to say, about 10 miles of roads could be watered twice a day—total, 20 miles, if and when required. I may add that, from information received from other towns, this is a low estimate for watering by motor traction. (Southend, 26 miles per day, with a bad water supply. Blackpool, 48 miles per day.)

My estimate is based on the purchase of an 800-gallon van, which would only require filling once about every 1,200 to 1,250 yds.

This van would also travel faster than a horse-driven vehicle when watering, and also when travelling to a standpost for "fill up" purposes.

The approximate cost per day for a motor vehicle would be—

	£	s.	d.
Petrol	1	13	2
Steam	1	13	11
Electric	1	13	0
Petrol-electric	1	10	10

SCAVENGING.

By the present system of horse labour an average of three loads of sweepings are picked up daily and carted to the tips.

If mechanical traction is employed on this work the only time saved would be in travelling to tip, and as a set-off to this there would be the wastage of the time of one man—viz., the driver of the vehicle—as the driver of a horsed-vehicle assists in picking up. (I understand one firm is about to introduce a machine which it will be possible to drive from the side to facilitate this work.)

In connection with scavenging on asphalted or granite pitched highways, great saving is being experienced in other towns by the employment of mechanical sweepers, and as you will see on the previous pages of this report the officials testify to the valuable work performed by these machines. At Leeds it is said a motor sweeper equals the work of 2½ horses, while statistics from Deptford Borough Council show the "all in" running cost of the motor sweeper for one year to be £396 7s. 1d., against the cost for similar work by horse labour as £665 14s. 3d.

A machine of this type, constructed such as I have mentioned, could be, in my opinion, very profitably employed on highways in this town.

A fair day's work for horse-work would consist of sweeping a distance equal to 8 miles of highway one-broom width (7 ft.), or 12 miles of the same width on granite paved or asphalted highways.

A motor vehicle would easily treble these distances.

My comparative estimates of the running costs of horse labour and machines engaged on this work is—

Horse labour, 12s. per day, to which must be added the capital cost and depreciation of the machine, which is the council's property.

Petrol sweeper, £1 7s. 6d. per day.

In this instance I have been obliged to take the figures supplied by the Deptford Borough Council, who have a petrol sweeper in use.

You will no doubt readily conceive that the ideal money, labour and time saving vehicle would be a combined mechanical sweeper and collector.

There is one machine on the market of this kind, but I have not considered the same in this report, as I do not consider the same suitable for our macadam roads.

GULLY AND CESSPOOL EMPTYING AND CLEANING.

At present this work is being carried out with horse labour by methods of which you are all conversant, that of ladling up the filth by manual labour.

The method I am about to put before you is a mechanical one. A suction hose is put into the gully, the filth extracted, and the gully cleaned out by means of a vacuum process. The gully is then partially filled with disinfectant solution; the whole operation usually takes between four and eight minutes, but this time is dependable on the solidity of the filth.

It is possible by the present method to clean out an average of thirty gullies per day, at a horse-labour cost of 12s., plus capital cost and depreciation of tank.

By means of a petrol, steam, or electric motor vacuum emptier and cleanser, it will be possible to empty about 100 to 120 gullies per day, at an approximate cost of—

	£	s.	d.
Petrol vehicle	1	13	2
Steam	1	13	11
Electric	1	13	0
Petrol-electric	1	10	10

In regard to cesspools, these can be emptied by the same process, and having regard to the distances between many of the stopping-places, great saving in cost of travelling will be effected, in addition to quicker and more healthy actual working.

It is also possible with this machine to carry out the work of cleansing manholes and flushing sewers, and at any time the vehicle was not engaged on either of the previous services it would be utilised in the work

I feel sure you will readily conceive the advantages in this service, which is not only more sanitary from every point of view than the old method, necessitating the employment of open carts and hand scoops, but is much quicker in its operations, and can also show a saving. These are prominent factors in its favour.

The services set forth in this report are those I consider stand out prominently, and show advantages worthy of your careful thought.

There are other branches which might with advisability be considered in the future, such as the removal of house refuse, adaption of mechanical watering tank wagons for sewer flushing, tar-spraying, light motor van for conveying stores to schools, and other public buildings, motor ambulances, &c.

Having dealt in detail with the branches of the service I consider for the purpose of this report most important, I will endeavour to estimate the financial saving to the town by the adoption of mechanical traction.

Haulage Work.

About 7,000 tons of material are carted annually (in normal times) for my department in what I will term the 2-mile area, and in the figures already given the effect on this basis would be as follows:—

Day-work.

Petrol vehicle—saving about £175 over horse labour.

Steam vehicle—saving about £166 5s. over horse labour.

Electric vehicle—saving about £204 3s. 4d. over horse labour.

Petrol-electric vehicle—saving about £268 6s. 8d. over horse labour.

Piece-work.

Petrol vehicle—saving about £96 5s. over horse labour.

Steam vehicle—saving about £87 10s. over horse labour.

Electric vehicle—saving about £125 8s. 4d. over horse labour.

Petrol-electric vehicle—saving about £268 6s. 8d. over horse labour.

Street Watering.

Petrol vehicle—saving about 14s. 10d. per day, or £370 16s. 8d. per season, over horse labour.

Steam vehicle—saving about 14s. 1d. per day, or £352 1s. 8d. per season, over horse labour.

Electric vehicle—saving about 15s. per day, or £375 per season, over horse labour.

Petrol-electric vehicle—saving about 17s. 2d. per day, or £429 3s. 4d. per season, over horse labour.

Sweeping.

Petrol sweeper—saving about 8s. 6d. per day, or £85 per annum (at an average of 200 days per annum), over horse sweeper.

Gully and Cesspool Emptying.

Petrol emptier—saving about 6s. 10d. per day, or £102 10s. per annum, over horse work.

Steam emptier—saving about 6s. 1d. per day, or £91 5s. per annum, over horse work.

Electric emptier—saving about 7s. per day, or £105 per annum, over horse work.

Petrol-electric emptier—saving about 9s. 2d. per day, or £112 10s. per annum, over horse work.

I therefore estimate that the provision of motor traction in this town would result in a financial saving to the council of approximately—

—	Petrol.	Steam.	Electric.	Petrol-electric.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Haulage	96 5 0	57 10 0	125 8 4	268 6 8
Street watering	370 16 8	352 1 8	375 0 0	429 3 4
Sweeping machine	85 0 0			
Gully, &c., emptier	102 10 0	91 5 0	105 0 0	112 10 0
	£654 11 8	£530 16 8	£605 8 4	£810 0 0

The following is a list of manufacturers of motor vehicles to whom I wrote for quotations for petrol, steam or electric vehicles, all to be fitted with interchangeable bodies to accommodate haulage, slop or liquid, water-tank bodies, and gully vacuum emptiers:—

Thornycroft & Co., Limited.
Leyland Motors, Limited.
T. Green & Sons.
Fodens, Limited.
Clayton & Co.
Garrett & Sons, Limited.
Yorkshire Commercial Motor Company.
National Steam Car Company, Limited (coke motor).
Edison Accumulators.
W. & F. Archer.
Waller & Sons.
Lacre Motor Car Company, Limited.
Albion Motor Car Company, Limited, Scotstoun, Glasgow.
J. & E. Hall, Limited.
Tilling-Stevens, Limited.
H. J. Burford & Co., Limited.
Commercial Cars, Limited.
Mossay & Co.
Scottish Commercial Cars Company, Limited.
Daimler Company, Limited.
Straker-Squires, Limited.
Dennis & Sons, Limited.
General Vehicle Company, Limited.
Wolseley Motors, Limited.
Baker Electrics (Wolseley).
Halleys Industrial Motors, Limited.
Alldays & Onions.
Clayton & Shuttleworth, Limited.
Mann's Steam Cart and Wagon Company, Limited.
Alley & McLellan, Limited.
Robey & Co., Limited.
McCurd Lorry Manufacturing Company, Limited.

In concluding I would like to state that I consider the figures given you might, in fairness to mechanical traction, be lessened, and there are points which might be particularly mentioned in order to show that even greater economy than I have shown could be effected.

It is quite possible to adopt the lorries for tar-spraying granite roads in order to carry out the work more expeditiously than by the present system of hand spraying. This suggestion I have not dealt with in the report.

If the vehicles could be worked during the night the standing charges would be spread over nearly double the number of hours, and the standing capital charges as shown would be halved.

As you will realise, each motor vehicle represents invested capital, and, as I have stated, the longer hours the vehicle works—in order to give greater returns on the capital—the better chance it will have of being a good investment.

For use at the present moment the item of 1s. 6d. per gallon for petrol is under-estimated, but, on the other hand, this council twelve months ago were purchasing petrol at 11½d. per gallon (municipal authorities having the benefit of the Government tax deducted). If the cost of petrol is again reduced to this level the figures given will, in turn, be over-estimated.

In the figures given a six years' life has been allowed the vehicles, but you will bear in mind the Local Government Board granted ten-years' loans for the motor fire engines, and from the information I have received, motor vehicles of municipal authorities have an average life of considerably over twelve years. (See Chiswick.)

It is necessary to mention here that, should the council decide to purchase any machine or machines, and the expenditure is raised by means of a loan for ten years at 5 per cent interest, the annual repayments of loan and interest will amount to about—

Petrol vehicle, say £800,	£116 14s.	(300 working days per annum)	
Steam " " £700,	£102 13s.	(250 " " ")	
Electric " " £1,300,	£155 8s.	(300 " " ")	
Petrol-electric, " £900,	£119 11s.	(300 " " ")	

The figures of the day or mileage costs on which my approximate estimate was based are not increased by this means of dealing with the capital outlay, except in the case of the steam vehicle.

As you are no doubt aware, prices for motor vehicles of this character are to-day greatly in excess of the usual pre-war prices. I am informed by manufacturers that after the war vehicles will be turned out at considerably less cost than at present, while the maintenance and tyre costs will also be a good deal cheaper.

After giving this important matter every consideration, I am of the opinion that full and constant work could be found in my department for four vehicles, with interchangeable lorry and water tank bodies; one gully and cesspool emptier and cleanser; one road sweeper with water sprayer, all of which could be worked to the benefit of the town. Whether or not it is advisable to purchase mechanically propelled vehicles now or after the war, if at all, is a matter for your consideration.

Women as Street Workers.—The fifty women who have been engaged doing seasonal work on the Birmingham roads have now completed their service with the corporation. Experiments in employing women in the street-cleansing department have been a success, and may be repeated next summer.

Municipal Tramways and War Problems.—In delivering the presidential address at the fifteenth annual conference of the Municipal Tramways Association, at the Surveyors' Institution, Westminster, on the 21st inst., Mr. Peter Fisher, general manager of the Dundee corporation tramways, stated that forty-four municipal tramway undertakings had been certified under the Munitions of War (Amendment) Act, 1916, and many others were authorised to issue class B priority certificates, to facilitate the delivery of supplies for maintenance. It was not always realised that tramways were playing a very important part in the national crisis in carrying workpeople from their homes to factories. The outstanding features of the year were the readjustment of tramway fares and stages, the employment of women on a large scale, and the introduction of volunteer labour for driving—the last-mentioned innovation having been introduced in Birmingham, Newcastle and Bradford, where 320 auxiliaries were employed with quite satisfactory results. There were now 8,609 women employed on tramways—8,433 as conductors and 176 as drivers—and 20,905 municipal tramway employees had joined the fighting forces, or 38 per cent. The development of tramways from a passenger-carrying point of view had occupied attention almost entirely in the past; now the other point of view—viz., transit, such as tramways could offer for goods—should have the fullest consideration.

Institution of Municipal and County Engineers.

EAST MIDLAND DISTRICT MEETING AT MELTON MOWBRAY.

Mr. E. G. Mawbey, borough engineer of Leicester, the district chairman, presided at an East Midland District meeting of the Institution of Municipal and County Engineers held at Melton Mowbray on Saturday last. The attendance included Messrs. H. J. Coleby (Atherstone), H. C. Coales (Market Harborough), A. T. Ross (Lutterworth), W. Bell (Oadby), T. W. Gordon (Nottingham), W. B. Purser (Kesteven), H. Hudson (Chesterfield), W. Thompson (Mansfield), W. S. Woodcock (Oakham), W. E. Jeeves (Melton Mowbray), E. H. Crump (Hinckley), W. E. J. Clark (Wigston), G. W. Hawley (Nottingham), N. Lamb (Nottingham), J. S. Wilkes (Newark), F. W. Mann (Leicester), T. Wood (Leicester), A. L. Parker (Oakham), E. E. Fryer (Melton Mowbray), J. C. Haller (Notts), W. T. Hazeltine (Wath-on-Dearne), S. Maylan (Basford), and W. E. Moore (Leicester).

The proceedings opened at Colles Hall, where the members were given a cordial welcome by the vice-chairman of the urban district council, Mr. R. W. Brownlow. In reply on behalf of the institution, Mr. Mawbey remarked that they had been trying hard for some time past to have a meeting in the town, and they were greatly indebted to the surveyor, Mr. Jeeves, for arranging the gathering and preparing what he thought they would all admit was a very excellent paper. Occasionally at such meetings they saw something to avoid, but as regarded the sewage purification works which they were to visit that day he could say without hesitation that they had in these an admirable installation, and one which produced an effluent that any local authority might well be proud of.

Captain E. H. Crump, Royal Engineers, who, as will be seen from the attendance list, was among the company present at the meeting, was welcomed by the members on his return from France on short leave of absence.

RE-ELECTION OF DISTRICT COMMITTEE.

The executive committee for the district was unanimously re-elected as under:—

Notts: Messrs. F. P. Cook (Mansfield Woodhouse), T. Henry (Retford), and T. W. Gordon (Nottingham).
Leicester: Messrs. A. H. Walker (Loughborough), A. Ross (Lutterworth), and W. H. A. Court (Leicester).
Lincs: Messrs. H. G. Whyatt (Grimsby), W. B. Purser (Kesteven), and E. Lake (Bourne).
Derby: Messrs. J. W. Horton (Derbyshire), V. Smith (Chesterfield), and C. A. Clews (Derby).

A paper by Mr. Edmund Jeeves, the surveyor to the urban district council, entitled

THE MUNICIPAL WORKS OF MELTON MOWBRAY,

was next submitted for discussion. The contribution is reproduced on another page of this issue.

Mr. W. B. Purser (Kesteven), in proposing a vote of thanks to Mr. Jeeves, remarked that the figure of £135 per mile for the maintenance of main roads and that of £65 for other roads seemed very reasonable at the present time. The cost of surface spraying also seemed very low. He would like to know if Mr. Jeeves used granite chippings. They cost him (the speaker) a little more than ½d. per yard. As regarded the sewage works, he would like to ask whether there was any likelihood of any secondary decomposition taking place in the effluent. He considered Melton Mowbray was to be congratulated both on their sewage system and on their destructor. To get the whole of their power for pumping from the latter was excellent.

Mr. H. G. Coales (Market Harborough), seconding the proposition, mentioned that his own town, a similar one to Melton Mowbray, had in operation a temporary isolation hospital, the administration of which cost only £120 per annum, as compared with the £500 per annum expended by the authorities of Mr. Jeeves' district. The temporary structure had been the subject of condemnation by the county medical officer, but when the death rates of the two places were compared he did not think this was justified. Mr. Coales added that he would like to have the analysis of the water supplied to Melton Mowbray, and some information as to its source.

Mr. T. W. Gordon (Nottingham) put an inquiry as to the amount of material delivered at the destructor per annum. Was, he went on to ask, Melton Mowbray a water-closet town? He had had some experience of dealing with a non-water-closet town, which he was sorry to say Nottingham was at present, and at their destructor they were often called upon to deal with large quantities of nightsoil—which was not good for steam-raising purposes.

Mr. E. H. Crump (Hinckley) asked whether the local spinning mill company paid anything for the treatment of their sewage, because it was not reasonable to think that a town whose sewage works had previously been adequate for its needs should be compelled to embark on an expenditure of £20,000 owing to a single factory coming into operation. At Hinckley they had been confronted with a similar problem, but they had an arrangement by which the dyeworks there paid so much per 1,000 gallons of effluent discharged into the sewers. He would like to know why the district council of Melton Mowbray bore the cost of the flagging of new streets; his view was that under their by-laws they could ask the owners to pay for any work of that kind.

Mr. H. Hudson (Chesterfield) asked if Mr. Jeeves would give the volume of effluent that came from the spinning mill. It seemed rather extraordinary that the volume per head of the population worked out at 36 gallons, and a lot for a small place like Melton Mowbray. He noticed also that the capacity of the filters worked out at 27 gallons per cube yard. That was a lot. Were the works made large owing to the effluent from the spinning mill?

Mr. W. Thompson (Mansfield) inquired whether any nuisance had resulted from the old refuse stored on the destructor site and used during the summer months when the supply of refuse from the town was insufficient to keep the plant going. The point with regard to the flagging of the footpaths was one which he also would like to know more about. The sewage works seemed large, having regard to the dry-weather flow, but that might be explained by the large percentage of foul effluent from the spinning works.

Mr. H. J. Coleby (Atherstone) said he would like to know the geological formation from which the town water was derived, and whether the character of the water had had any effect on the mains.

Mr. J. C. Haller (Notts) expressed the opinion that Mr. Jeeves was doing very well in the matter of the contribution towards the cost of tar-spraying. As to the flagging of new streets, he certainly agreed that property owners should complete streets before the thoroughfares were taken over by the local authority.

Mr. Purser, in some further remarks at this point, said it seemed unnecessary to have, as was the practice at Melton Mowbray, 9 in. of slag as a foundation to all new streets. He would like to know whether that was irrespective of the substratum, because ground varied everywhere. Also was there any advantage in having a depth of 6 in. of ashes under the footpaths.

Mr. J. S. Wilkes (Newark) commented on the fact that, in spite of Melton Mowbray being right in the heart of the slag-producing district, the authorities seemed to stick to the old, benighted way of making roads with granite. He found it was possible to convert slag to tar-macadam at a cost of about 2s. per ton. That was below the cost of granite, and the resulting road was superior to a granite road. Concluding his remarks, Mr. Wilkes said he would like to recommend the council to go in for town planning powers.

Mr. W. Bell (Oadby) agreed that the cost of flagging private streets should be borne by property owners. Referring to the point as to the possibility of secondary decomposition taking place in the sewage effluent, he observed that that might occur if it were conveyed a long distance. He would like an analysis of the sewage before it was treated. As to the stored-up refuse at the destructor, he took it the material was deposited before the destructor was started, and when it was exhausted the question of a coal bill would have to be considered.

Mr. W. H. A. Court (Leicester) asked whether the sewerage system of the town was a duplicate one,

or whether the whole of the storm water had to be pumped.

The vote of thanks was carried.

Mr. Jeeves, in replying, stated that as regarded tar-painting they got a refined tar at 2½d per gallon, and paid 8s. per ton for their granite chippings. He put the average for three years at 1½d. per super. yard, but this year it was 1d. Their roads were on clay, and if they did not have 9 in. of slag they would not stand the steam roller at all. Even with 9 in. it was difficult, and it was the same with the footpaths. With regard to the use of granite, the county council did not allow slag. Being in a hunting country, they had a tremendous amount of horse traffic, and smooth surfaces were productive of complaints. He agreed that roads should not be taken over until the footpaths had been flagged. It was, however, a matter for his council. It did not seem fair to him that the ratepayers should bear any of the cost of developing private property. As to the water, he would give any member a copy of the destructor. Melton Mowbray was a water-closet town. They previously had a system of privy pits, but these were practically now all done away with, and so they had no nightsoil to deal with at the destructor. He agreed that it would be a great advantage to a town like theirs to have a town planning scheme.

Before proceeding on visits to the destructor pumping station and the sewage disposal works the members partook of tea at the Bell Hotel on the invitation of the chairman of the council, Mr. Sholto H. Sikes, J.P.

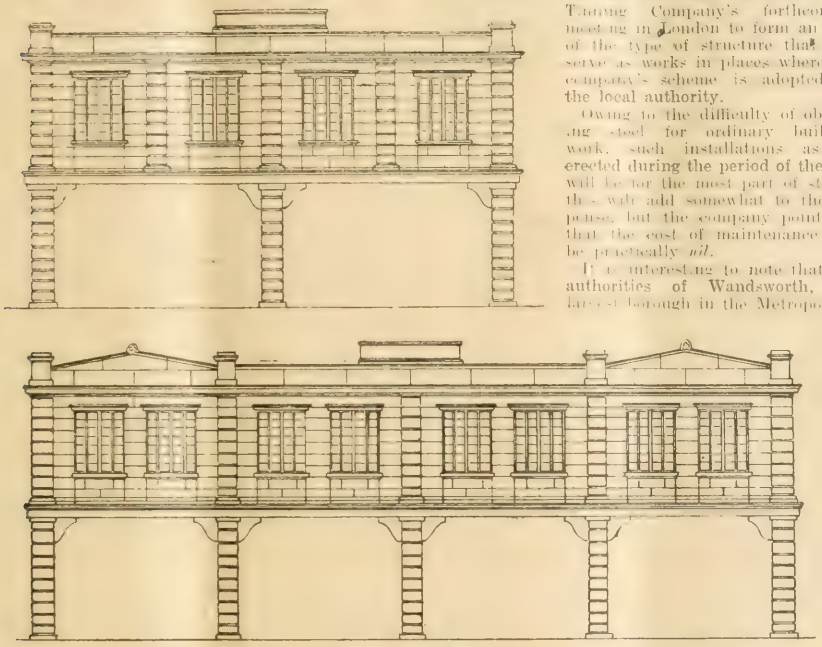
BRITISH DE-TINNING COMPANY'S SCHEME.

THE SOUTHWARK WORKS.

The drawings reproduced herewith, which illustrate the building to be erected at the borough of Southwark's depot at Manor-place, will enable those who are to attend the British De-Tinning Company's forthcoming meeting in London to form an idea of the type of structure that will serve as works in places where the company's scheme is adopted by the local authority.

Owing to the difficulty of obtaining steel for ordinary building work, such installations as are erected during the period of the war will be for the most part of stone; this will add somewhat to the expense, but the company point out that the cost of maintenance will be practically *nil*.

It is interesting to note that the authorities of Wandsworth, the largest borough in the Metropolitan



Scale ⅛ in. to a foot.

British De-Tinning Company's Works at Southwark—Elevations.

analysis on request. The water came from the rock under the blue lias, and it did not seem to have had much effect on the mains. There had been no trace whatever of secondary decomposition in the sewage effluent, which went through an open channel for about 400 yds. before discharging into the river. They had not had any analyses taken, and he thought it was not wise to make such analyses until there were some complaints. (Laughter.) There was no doubt the sewage was a very strong one, but the explanation of the size of the works was that the council desired to provide for some years ahead, and therefore went to more expense than was probably necessary. There was no doubt that the spinning mill was the main cause of the new sewage works. Investigations showed that the mill was discharging some 80,000 gallons of waste daily, and the proportion of that to the ordinary town sewage made the sewage very bad. The company obtained the *entrée* to the sewers, and the council had to make the best of it. Nothing whatever was paid for the treatment of their wastes, but there was no doubt it was paid for in the increase of the rateable value. The sewerage was not a separate system, and the whole of the storm water went into the sewers. They received practically about 6 tons of refuse per day at the destructor. There was no doubt that would be insufficient to keep the destructor going unless the town increased in size. An enormous heap of material had accumulated prior to the erection of the

area, have accepted proposals for a similar plant, as also have the corporation of Southend-on-Sea.

The number of applications to attend the conference has been so large that the company do not propose to issue any further invitations, except to representatives of very large boroughs who up to the present moment have not received particulars, but all persons who have already returned the slips will receive fourteen days' notice of the meeting, together with a programme for three days.

In all probability, owing to the amount of labour involved in the preparations for the gathering, the meeting will not take place until next November.

Within the next few weeks, we understand, the British De-Tinning Company hope to remove their head office from Birmingham to Westminster.

Battery Vehicles at Ipswich: Working Costs.—From a report it appears that the 3-ton battery-equipped tipping wagon supplied to the Ipswich Town Council by the General Vehicle Company, Limited, ran 6,154 miles during the year ended March 31st last, and dealt with some 9,000 tons of material. The inclusive cost of working, with allowance for maintenance and depreciation, was £396 16s. 7d., or approximately 15·5d. per mile. The electric energy was represented by 7,961 units charged at 1d. per unit, the average consumption being therefore about 1·3 unit per mile.

Activated Sludge Process in Treatment of Tannery Wastes.

By HARRISON P. EDDY and ALMON L. FALES.

The activated sludge process of sewage treatment may be particularly well adapted for the treatment of some industrial wastes. The firm with which the writers are connected (Metcalf & Eddy, consulting engineers, Boston and Chicago) is now directing activated sludge tests on paper-mill wastes at the mills of Bird & Son, East Walpole, Mass., on woollen mill wastes at the Assabet mills of the American Woollen Company, Maynard, Mass., and on tannery wastes at the factories of Winslow Brothers & Smith Company, Norwood, Mass. The tests on woollen mill wastes have not been conducted for a sufficient length of time to afford any indication as to the practicability of treating these wastes by the activated sludge process. The tests on the paper mill wastes are not very encouraging, although various modifications of the process, which are being tried on an experimental scale, may solve the problem. The results of the tests on the tannery wastes are very promising, although it remains to be determined whether the method will be economical. A brief account of the activated sludge tests made thus far on these tannery wastes may prove of interest.

CHARACTER OF WASTES.

The Winslow Brothers & Smith Company manufacture sheep, calf and kid leather and pulled wools. The wool-scouring liquors, amounting to about 30,000 gallons a day, are degreased by the acid-cracking process, and a large part of the grease is subsequently recovered. The combined wastes from the tannery and degreasing plant average about 500,000 gallons each working day. This does not include about 250,000 gallons a day of comparatively clean rinse waters discharged into the brook without treatment other than by fine screens.

The individual wastes from the various processes are discharged at different times and in different quantities, causing a marked variation in the character of the combined wastes. The composite for the day is grey or brown in colour, densely turbid, and malodorous. It contains much suspended matter, but after settling remains densely turbid. Tests showed that for each 100 parts by weight of solids settling in twenty-four hours, there were 63 parts of non-settling suspended and colloidal matter. The combined wastes are frequently acid in nature, due to the discharge of certain acid wastes, but the daily composite is generally alkaline.

Table I.—Tests of Combined Factory Wastes and Activated-sludge Tank Experiments at Factory of Winslow Brothers & Smith Co.

Results in parts per million (except last column).

	(A) Factory wastes.			(B) Activated sludge.		
Determinations.	Aver. for 1915.	Monthly Average. Max.	Monthly Average. Min.	Tank tests (a). In-fluent.	Tank tests (a). Ef-fluent.	De-crease per cent.
Total oxygen consumed	889	979	759	785	258	67·1
Dissolved	554	670	386	605	241	59·6
Suspended	335	427	259	180	14	92·2
Total albuminoid nitrogen	29·3	36·4	21·1	21·5	5·5	73·0
Dissolved	16·2	21·9	10·8	16·0	4·4	72·5
Suspended	13·1	18·7	9·9	5·5	1·4	74·6
Ammonia nitrogen	17·9	25·1	12·3	25·5	9·9	61·1
Nitrites	—	—	—	—	1·90	—
Nitrates	—	—	—	—	0·06	—
Total residue ...	3915	4902	2882	3088	2356	23·7
Loss on ignition ...	1452	1862	1057	836	272	67·3
Fixed residue ...	2463	3339	1825	2252	2084	7·4
Total dissolved solids	2971	3560	1766	2726	2340	14·1
Loss on ignition ...	571	696	375	511	258	49·8
Fixed residue ...	2451	3025	1588	2212	2082	5·8
Total suspended solids	1246	1690	993	362	16	95·6
Loss on ignition ...	881	1294	624	324	14	95·6
Fixed residue ...	412	674	248	40	2	95·0
Total sulphur	237	360	144	232	251	0·4
Fats by ether extraction	486	780	312	255·2	48·5	81·1

(a) For week ending April 1, 1916.

The average results of analyses of the crude wastes for 1915, together with the maximum and minimum monthly averages for the different constituents, are given in Table 1 (A). These wastes are several times as strong as ordinary domestic sewage. It was found that one volume of settled wastes required, on the average, about 50 volumes of unpolluted brook water to produce stability. These wastes have a marked avidity for oxygen, as much as 240 milligrams of oxygen per litre of wastes being absorbed immediately from water used for dilution. This would be enough to saturate with dissolved oxygen about twenty-five times this volume of distilled water at room temperature.

PRESENT METHOD OF TREATMENT

The combined wastes are pumped to sedimentation tanks, having a total capacity of nearly 1,000,000 gallons. Lime in the form of milk of lime is added to the crude wastes whenever necessary in sufficient amount to maintain an alkaline tank effluent. A portion of the tank effluent is applied to sand filter beds, an area of 3·5 acres being available for this treatment. The remainder is treated by dilution with water from an 800,000,000-gallon reservoir controlled by the company.

OBJECT OF EXPERIMENTS.

Sufficient diluting water is not available for complete oxidation of the tank effluent during the greater part of the year. Several times the present area of filter beds would be required to filter properly the entire volume of wastes under favourable weather conditions, and it is not practicable to keep the filter-beds in working order during the winter. Moreover, the cost of operation and maintenance of the filter-beds has proven excessive, principally because of the very large proportion of finely divided suspended matter and colloids in these wastes.

In order to ascertain whether the trickling filter would not be better adapted for the purification of these wastes tests on a large working scale were authorised. These tests, carried on for eighteen months, indicated that by this method a satisfactory effluent could be obtained at much less cost than by the sand filter method. The principal drawbacks in this process were the danger of the dissemination of foul odours by the spraying of the liquid on the filter and possible trouble from moth flies, which are common to this type of filter. The cost of construction of a 1-acre trickling filter 7·5 ft. deep with dosing tank, secondary sedimentation tanks, and other equipment capable of satisfactorily purifying all of the waste waters from the factory was estimated at $63,480 (£12,696).

Before the trickling filter tests were completed the activated sludge process of sewage treatment came into prominence. This process, if it could be economically applied to the treatment of these wastes, promised to avoid any possible fly nuisance and to reduce foul odours to a minimum. Moreover, it was to be expected that a suitable activated sludge plant might be constructed for much less than the cost of a trickling filter plant. We were accordingly authorised by the company to conduct activated sludge tests on a working scale.

DESCRIPTION OF EXPERIMENTAL PLANT.

A 1,000-gallon aëration tank, approximately 6 ft. long, 3 ft. wide and 8 ft. deep, was built in one corner of the press-room of the degreasing plant. This room is not very warm in cold weather, but the temperature is high enough to prevent freezing. The tank is provided with a complete false bottom of filtros plates (grade 5 R), 6 in. above the true bottom, for diffusion of the air. The air space is divided into three independent longitudinal ducts, to make it possible to cut out the outside ducts, and by sloping the sides to the middle duct to operate with one-third of the volume of air required for agitation with the complete false bottom if it should be found that a smaller volume of air is sufficient for oxidation. The air is taken from the pipe supplying compressed air for mixing the treated wool-scouring liquors in the acid-cracking tanks, under a pressure of about 50 lb. per square inch, which is reduced to the required pressure of approximately 3·5 lb. by a Mason pressure-reducing valve. The consumption of air is measured by a Westinghouse gas meter.

The joints between the filtros plates were first made with Arco-Sealit roofing compound. When the liquid in the tank reached a temperature between 70 deg. and 80 deg. Fahr., this material softened, and the pressure of air from beneath blew holes through it. Various high-melting-point pitches and asphalts were tried, but none was found which we felt certain would not give way under the conditions of warm tempera-

ture and air pressure. The lower part of the joints was then made with one of the best pitches and the upper part was filled with rich cement mortar.

The wastes are drawn by gravity into the aëration tank, and the supernatant liquor is drawn off by means of a flexible-jointed pipe. A sludge draw-off pipe is provided at the bottom of the tank. Provision is made for sampling from the influent and effluent pipes during the filling and drawing of the tank, and four sampling outlets in the tank at different depths are available for making special tests.

PRELIMINARY TREATMENT.

In view of the constantly-changing character of the wastes during the day it was considered necessary to equalise them before applying the activated-sludge treatment. It was therefore decided to use the effluent from the sedimentation tanks for the tests. By this preliminary treatment there is removed not only the heavy matter in the wastes, which would require an excessive amount of air to keep it in suspension, but also the other settling suspended matters, which would require large amounts of air for their oxidation. No difficulty has been experienced in dewatering the sedimentation sludge on drying beds without causing complaints from foul odours. All the dried sludge is being carried away, without expense to the company, by the farmers in the vicinity, who use it as fertiliser.

BEGINNING OF TESTS.

The aëration tank was put into operation December 29, 1915, on a schedule of one filling each working day. Air was applied at a sufficient pressure to maintain a good agitation of the tank contents, and the aëration continued for about twenty hours, when the aërated wastes were allowed to settle for a period of two hours, after which the supernatant liquor was drawn off and replaced with fresh sedimentation-tank effluent. The tank was not filled on Sundays, and air was applied for about forty-four hours, from Saturday to Monday. After nine fillings it was found that 4·6 per cent of sludge (based on two hours' sedimentation) had accumulated in the aëration tank, but the treatment was effecting no perceptible change in the liquor applied.

ARTIFICIAL HEATING OF WASTES.

It became apparent that it would be a very slow process, if indeed possible, to activate the sludge at the low temperature of the wastes, less than 50 deg. Fahr. It was therefore considered advisable to warm the tank liquor to expedite the tests. It is impracticable to do this by heating the air supplied. The specific heat of air is approximately 0·238 (water = 1), whence 4·2 times as much air as water by weight is required to produce a given result in heating or cooling. The specific gravity of air is 0·00129 + (water = 1), whence one volume of water weighs the same as 775 volumes of air. The relative volumes of air and water at a given temperature to have the same calorific power are, therefore, as 3,250 : 1. On the basis of the above computations 100 times the actual quantity of air being used for twenty hours' aëration would be required at 90 deg. Fahr. to raise the wastes from 50 deg. to 70 deg. Fahr. in twenty hours. If the air were heated to 212 deg. Fahr., 500 times the quantity of air being used per hour would be required to raise the temperature of the wastes from 50 deg. to 70 deg. Fahr. in one hour. The quickest and most economical way to heat the liquor appeared to be by live steam admitted to the tank. The application of a moderate amount of steam for two to three hours is sufficient to raise the temperature of the wastes to 70 deg. Fahr. The effect of live steam on the bacterial life within the filter was conjectural. It was found, however, that after less than one day's aëration at the higher temperature the dark grey liquor became reddish in colour and showed partial clarification.

After carrying on the tests for two or three days at the warm temperature the pitch which had been used to form the joints between the filtros plates softened to such an extent that the air pressure blew holes through it, thus necessitating the withdrawal of the sludge and the making of new joints with cement-mortar as previously described. The tank was out of use from January 10th to January 22nd, during which time the sludge accumulated prior to January 10th was stored in a cool place. When it was returned to the tank on January 22nd it had become very foul—in odour like decaying fish. In spite of this fact, there was a decided improvement from the first in the appearance of the tank liquor on aëration at the warm temperature. The top liquor drawn January 28th was free from disagreeable odour, and was only slightly turbid.

ACTIVATION OF SLUDGE.

By February 7th there had accumulated 20 per cent of sludge, based on a working capacity 7 ft. 6 in. deep and a period of sedimentation of two hours. It was then decided to aërate continuously without further addition of liquor until the sludge became activated. Steam was applied from time to time with a view to maintaining a temperature between 65 deg. and 75 deg. Fahr. Occasionally the temperature dropped below 60 deg. Fahr., but the liquor was not allowed to remain at that temperature for any considerable length of time.

The nitrite and nitrate nitrogen in the liquid being aërated gradually increased from a trace on February 8th to 3·5 parts per 1,000,000 on February 17th. It then jumped to 12 parts per 1,000,000 on the following day, and continued to increase, reaching about 35 parts per 1,000,000 on February 24th, which is higher than has ever been obtained in the effluent from the sand filters. Nearly all of this was nitrite nitrogen. The continuous aëration was extended until March 6th to ascertain whether it would be possible to convert the nitrite into nitrate. This was not accomplished, presumably because the nitrate-forming organisms were absent.

On February 18th, after eleven days' continuous aëration, the settled tank liquor was found to be perfectly stable. A chemical analysis of a sample collected February 25th showed 4·9 parts per 1,000,000 albuminoid nitrogen—a reduction of 63 per cent from that in the influent—and 0·5 part per 1,000,000 of ammonia nitrogen, a reduction of 97 per cent from that in the influent. Shortly after this the air was accidentally turned on at full pressure. This broke up the coagulant to a marked degree, so that much fine suspended matter remained in the liquor after settling for two hours. This fine suspended matter did not coagulate again on further aëration, and continued to render the tank liquor exceedingly turbid.

The continuous aëration started February 7th caused the sludge to become more granular in nature, so that it tended to be more compact on standing, and thus to occupy less space. Further, the continued application of air and the occasional introduction of steam tended to break up the coagulant, thus rendering the sludge resulting from sedimentation of the liquor denser and of less volume. The sludge volume of 20 per cent on February 17th was reduced to 13 per cent on February 25th, and after the excessive application of air to only 7·6 per cent on March 5th.

RESULTS OF OPERATION AT ONE FILLING A DAY.

Beginning March 6th, the tank was again put into operation on the schedule of one filling each working day. Air was applied at the rate of about 0·5 cub. ft. per gallon per hour, or approximately 10 cub. ft. per gallon per day, based on twenty hours' aëration. By the end of March the accumulation of sludge, based on two hours' sedimentation, was equivalent to 17·8 per cent of the working capacity of the tank.

The character of the effluent of the activated sludge tank continued to improve until it became practically clear and nearly free from suspended matter. Beginning March 16th, the effluent was perfectly stable by the methylene-blue test. No considerable amount of nitrification, however, is yet taking place. The last weekly analyses of sterilised composite daily samples of influent and effluent are given in Table I. (B). It will be seen that a very large proportion of the fine suspended matter and a considerable proportion of the dissolved organic matter in the influent are being removed by the activated-sludge treatment.

CHARACTER OF ACTIVATED SLUDGE.

The sludge from the aëration of these tannery wastes is reddish-brown in colour and flocculent in nature, being very similar to that resulting from the aëration of sewage. It is free from offensive odour and comparatively stable. Partial analyses of this sludge, made during March, gave the results appearing in Table II.

TABLE II.—PARTIAL ANALYSES OF ACTIVATED SLUDGE (PERCENTAGES)

Date 1916.	Moisture.	Dry Solids.	Composition of dry solids. Organic.	Mineral.	Fats.
March 5 ...	98·79	1·21	66·1	33·9	7·3
,, 10 ...	98·58	1·42	71·1	28·9	9·1
,, 18 ...	98·16	1·84	72·3	27·7	9·4
,, 27 ...	97·70	2·30	74·8	25·2	11·6

The increasing percentage of dry solids, organic matter, and fats in the accumulating sludge is worthy of note.

The analyses in Table II. were made on sludge

resulting from two hours' sedimentation. That there is a wide difference in the volume of sludge after different periods of sedimentation is shown by Table III.

Table III.—Volume of Activated Sludge after Different Periods of Sedimentation in Measuring Glasses.

Sedimentation periods (hours)	¼	½	¾	1	1½	2	3	4	18
Sludge (per cent of sample)	25·0	22·0	20·7	18·6	16·6	14·7	13·3	12·8	11·3

The amount of suspended matter remaining in the aëration tank liquor after different periods of aëration on April 6, 1916, gave the results noted in Table IV.

Table IV.—Suspended Matter (P.P.M.) in Aeration Tank Liquor after Different Periods of Sedimentation.

Periods of sedimentation, hours ...	¼	½	1	2	4	8
Suspended matter in supernatant liquor	260	86	64	50	32	22
Reduction by sedimentation in succeeding period	—	174	22	14	18	10
Reduction per hour	—	696	44	14	9	2·5

Though a very large proportion of the suspended matter was removed by half an hour's sedimentation, considerable fine suspended matter continued to settle after that. Undoubtedly mass action in a large tank would bring about more rapid sedimentation.

Amount of Air Required.

Considerable trouble has been experienced from frothing, due to the soapy character of the wastes aërated, and caused principally by the necessity of discharging some wool-scouring liquors into the wastes channel without degreasing until certain improvements in the degreasing plant have been completed. This trouble has necessitated cutting down the air supply to the minimum which will furnish sufficient agitation. At a rate as low as 0·25 cub. ft. per hour of air per gallon of wastes aërated, 20 hours' aëration was insufficient to produce stability. There are indications that double this rate of applying the air will be more economical. Even at the higher rates of application of air the aëration-tank liquors show only about 15 per cent saturation of dissolved oxygen after twenty hours' aëration. It is hoped that the period of aëration may be materially shortened as the tests progress. The effect of an increasing proportion of activated sludge, of reduction in the temperature of aëration, and of variation in the depth of liquor aërated remain to be studied.

MUNICIPAL SCHEMES AFTER THE WAR.

The circular of the Local Government Board asking for information with respect to projected schemes of improvement after the war has received consideration from the following local authorities in addition to those already mentioned in The Surveyor:—

Broadstairs U.D.C.—The matter has been referred to the General Purposes Committee.

Chipping Sodbury R.D.C.—The surveyor, Mr. W. M. Hudson, stated that work on the roads would probably cost £1,500, and employ thirty men for one year. Last year £1,200 less than the estimate was spent on the roads, and this year possibly £2,000 less. Another matter was the development of the council's quarry at Bury Hill, at a cost of £400, employing ten men for one year. A road in Hawkesbury Common, about 800 yds. long, where there was not room for two vehicles to pass, could be widened. The land would cost nothing, and the expenditure would be about £115. A further possibility was the widening of Filton-lane. The surveyor will submit a further report in a month.

Dundee T.C.—The question of the promotion of town planning schemes to provide work after the war was discussed at a meeting of the Housing and Town Planning Committee recently. In connection with the three schemes in existence the city engineer, Mr. J. Thomson, said he proposed to spend from £3,000 to £4,000 on roads, while £12,000 had been earmarked for housing. He proposed that they should intimate they were prepared to spend £30,000 or £40,000 on a housing scheme. This was agreed to.

Dunstable T.C.—The town council have informed the Local Government Board that they propose after the war to execute works for a storm-water sewer, and to make up certain private streets, at an approximate cost of £1,900.

Mytholmroyd U.D.C.—The chairman of the Highways Committee stated that several road widenings would have to be carried out, all of which affected the county council; also the widening of Navvy Bridge.

Norton R.D.C.—It was stated that the Weston and Birdsall water supplies would be undertaken after the war.

St. Asaph (Denbigh) R.D.C.—It has been intimated to the Local Government Board that among the schemes which the council hope to deal with after the war are the Llanddulas housing and water questions, the question of the road between Llanfair Talhaiarn and Llansannan, and other desirable road improvements.

Taunton R.D.C.—The council have replied that they are contemplating the improvement of Priors Wood-road, and the overtaking of neglected road and hedge works.

Tiverton R.D.C.—It has been decided to recommend as after-war work the widening and straightening of corners on the Culm Valley road between Uffculme and Hemyock.

Tring U.D.C.—It is intended to revive the paving scheme sanctioned by the council, but abandoned owing to the war.

Wivenhoe U.D.C.—There are no works of any magnitude in contemplation, except the repair of the roads.

Wrotham U.D.C.—The council have referred the circular to the clerk (Mr. H. E. Pyle) and the surveyor (Mr. F. T. Elliott).

Yiewsley U.D.C.—The circular has been referred to the Streets and Works Committee for consideration.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

When will the question of the appalling waste of water that now goes on everywhere be taken into serious consideration? Is it not time that something was done to try and put a stop to this waste of a commodity which the average consumer treats as if it were inexhaustible and to him quite negligible so far as any value is concerned?

* * * *

Why should not the suggestion made by Lord Montagu of Beaulieu at Glasgow the other day, that municipalities should erect local aerodromes for training in flying, be carried into effect? Is it not evident that this new fighting branch of our Services will grow into vast proportions and play a very large part in the warfare of the future? Will the design and erection of the necessary sheds and selection of the proper flying ground be added to the already bulky list of a surveyor's duties?

* * * *

Does not the disaster to the Quebec Bridge give us cause to think furiously upon the number of failures which occur "across the herring pond" in connection with engineering works on a large and small scale? Do not these disasters occur in a somewhat alarming ratio, or is it that the American engineers are always so ready, unlike those in this country, to place on record all known cases of failure? Is it a fact that the American engineer is rather given to cut his standards of strength down to the uttermost margin of safety on economical grounds?

* * * *

Will the proposal to invite competitive schemes for the town planning of Dublin lead to the almost inevitable discussion as to who is the right person to scheme and carry out such an important work? Is it not within the bounds of possibility that the successful competitor may be full of artistic ideas which may appeal to the committee, or assessor, when the designs are being considered, but that such a scheme may be impracticable when it is desired to carry it out? Is it not a fact that a successful town planning scheme involves a very large number of factors in addition to artistic effect?

* * * *

Is it not rather a novel suggestion that the sewage of Manhattan Island, New York, shall be treated in a number of small installations situated "under the streets at frequent intervals along the east and west water fronts," instead of at one large sewage disposal works, in accordance with the usual procedure? Can proper purification be carried out in

The Surveyor
And Municipal and County Engineer.

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this manner without serious local nuisance, and what would be the attitude of the officials of the Local Government Board in this country if such a proposal were made to them, by an engineer?

* * * *

Did not Mr. Wickham Kaye-Parry, the well-known engineer of Dublin, recently make some very useful suggestions in a local daily journal with regard to the rebuilding of the recently demolished property in that city? Was not the idea, among others, of a tribunal which could settle questions such as ancient lights, encroachments, and so forth, an excellent one for cheapening litigation? But will the lawyers not have something to say to this before it can be carried into effect?

* * * *

Was it not a very patriotic action of the ratepayers of Draws Pond, near Devizes, to set to work to level, make up, and roll a road at that place? When we read that a large number of ladies and gentlemen, soldiers, shopkeepers, boys and girls did this work under the supervision of the borough surveyor, are we not struck with the fact that this war is going to bring out the best in all of us, provided there is any best?

* * * *

Has not the Government of Australia acted very wisely in prohibiting the use of raw tar in connection with road construction and maintenance, so that all available supplies of benzine and toluol shall be shipped to this country for the manufacture of explosives?

* * * *

Does not half a gallon of petrol per week seem to be a very small allowance for the sanitary inspector of Cupar Fife to run a motor car, or even a cycle car, in connection with his duties? Was it surprising that when he reported to his council that this was the proposal of the Local Government Board the clerk was at once instructed to write to the Board of Trade and endeavour to get a certificate for at least two gallons a week? Does "kissing go by favour" in connection with these certificates for petrol; or how is it that we still see so many pleasure cars on the road?

Greenwich Borough Council's Additional War Bonus.—Greenwich Borough Council are proposing to grant all their employees in the adoptive acts and highways departments whose salary is not in excess of 40s. a week a further bonus of 4d. a day during the continuance of the war.

A WELSH SURVEYOR'S SALARY.

CARDIGAN RURAL COUNCILLORS "STUDY ECONOMY."

At a recent meeting of the Cardigan Rural District Council, the *Welsh Gazette* reports, Mr. Thomas Hughes moved that the surveyor's salary be increased from 21s. to 25s. per week (including 1s. war bonus) on condition that he devoted six days instead of five per week in the service of the council. He hoped the council would support his motion, as it was only fair to the surveyor that he should have a higher salary, as the cost of living and other matters affected him as much as anyone.

Mr. Thomas Griffiths, seconding, said there was no doubt the surveyor was entitled to an increase of salary. It had been reported to the council at the last meeting that he was doing his utmost to reduce the cost of maintenance and repair of the highways.

Mr. J. Gwendraeth James supported the motion.

Mr. Thomas Davies said he was not against the proposed increase, but in his opinion it was too much in comparison with the increase they had given the road labourers. Both roadmen and surveyor were equally affected by the high cost of living.

Mr. Evan Williams said he was surprised to find such a question before the council. (Laughter.) He thought the surveyor should be satisfied with his present salary. He considered that if the surveyor were employed by the council for three days a week it was sufficient for them. The question of the employment of labour was a big one: the roadmen had in the majority of cases to work by the perch for their wages. He thought the increase of salary quite unnecessary. The surveyor was granted a month's holiday every year, and he should be satisfied. (Laughter.) He had nothing against the surveyor, but he thought they should consider the ratepayers on a question like this, and study economy. Why should they make such an increase? There was no consistency if the question was applied to the whole district. He considered three days a week was sufficient to attend to the roads. It was far more important to devote every effort to harvesting than attending to the roads at such a time as the present. He understood that the surveyor was an excellent hand as a cobbler—(laughter)—and he would prefer to see him devote some of his time every week in this direction and try to earn a little extra money to meet the high cost of living. By giving him a higher salary it was simply a wastage of money and adding to the expense upon the ratepayers. He proposed that no increase be given. He thought any man could do the work of a highway surveyor. They should remember that there were people who suffered very much from the effects of the war who were helpless.

There was no seconder.

Mr. Thomas Davies said he was prepared to suggest that an increase of 3s. per week (to include the 1s. war bonus) be given to the surveyor.

Mr. T. Daniel seconded, but he considered an increase of 4s. was excessive.

On the vote being taken, there were for Mr. Hughes' motion 4, and for the amendment of Mr. T. Davies 3, the motion being declared carried.

Better Petrol Prospects.—The Petrol Control Committee intimate that they hope the improved supplies and stock available may enable them to increase the quantity of petrol allocated to the civil population on the re-issue of licences at the end of October.

Experimental Cottage Building. — Dunfermline Town Planning Committee have agreed to give authority to Mr. Walter Wilson, inspector of works, to erect an experimental cottage according to a method patented by him. The new type of cottage will be of reinforced concrete, and its internal design is such that it practically abolishes the use of woodwork, except for doors and windows.

Sewage Disposal at Cleethorpes.—The sewerage scheme of the Cleethorpes Urban District Council, which has taken over five years to construct, has been practically completed, at a cost of upwards of £80,000. The council originally proposed a scheme estimated to cost £45,000, but the Local Government Board insisted upon a scheme capable of dealing with a potential population of 75,000, and estimated to cost over £25,000 more than the council desired to spend.

The Municipal Works of Melton Mowbray.*

By EDMUND JEEVES, Surveyor to the Urban District Council.

Melton Mowbray is an ancient market town, situated in the fertile grass valley of the River Eye. There are still many old interesting buildings in the town. . . .

The area of the urban district is 2,686 acres, and the assessable value for poor-rate purposes £49,372. The population, according to the 1891 census was 6,392, in 1901 it was £7,454, in 1911 it had reached 9,202, and the estimated population in 1914, previous to the war, was 9,850. The estimated number of houses at the present time is 2,130, showing an average of 4·6 persons living in each house.

Up to now the housing of the working classes has been satisfactorily provided by private enterprise.

The average death rate for the past seven years is 13·35 per 1,000, which shows that Melton Mowbray ranks among the healthiest towns in the country, especially as in 1913 it was as low as 10·3 and in 1914 only 9·7 per 1,000.

PUBLIC ROADS.

There are four miles of main county roads in the district, which the council keep in repair by arrangement with the county council, who pay the cost, and twelve miles of other roads and streets, the whole of them being macadamised with granite, the average cost of maintenance for the past five years being about £135 per mile for main roads, and £65 per mile for other roads.

For the past six years, two miles of main roads have been tar-sprayed annually, and three miles of other roads and streets, at an average cost of 1½d. per super. yard. When tar-spraying the roads a space, about 1½ yds. wide, is left on each side for horse traffic which is found necessary in this district.

The Road Board allowed the whole cost of the tar-spraying until the last two years, when they have only contributed 1d. per super. yard towards the cost; the author considers this is most unfair, as, in his opinion, the process greatly increases the life of the road and reduces the expenses in many ways, so that the county roads are being improved partly at the expense of the local ratepayers.

The Private Streets Works Act, 1892, was adopted in 1906, and since then had been put in force in connection with six streets with good results.

All new streets are specified to have a foundation of hand-pitched lump slag, 9 in. thick, levelled on surface with broken slag, covered with a good coating of granite road metal and steam rolled at completion, the channels to be formed with four rows of granite setts, the kerbing of 10 in. by 4 in. granite on concrete foundation, and the pathways formed with bed of ashes 6 in. thick, coated with granite gravel and rolled. The council take over the streets when this work has been satisfactorily carried out, and afterwards pay the cost of finishing the surface of the pathways with asphalt or concrete slabs.

Trees have been planted in several streets, mostly by the owners when laying them out. The general effect is good, but the author considers it a mistake to plant them, except in very wide streets, as they are detrimental to light and air to the adjoining houses, to the kerbs and channels as the roots develop, and to the general scavenging and maintenance of the roads and pathways.

SEWERS AND SEWERAGE.

Previous to the year 1860, there were no sewers, the drainage of the town being conveyed to the river by open water-courses. In 1860 a primitive scheme for draining the town was carried out by Mr. Stevens, of Leicester, at a cost of £4,200. In 1875 Mr. Baldwin Latham was called in to improve the sewerage of the town and provide purification works; under his supervision a scheme at a cost of £16,000 was carried out with outfall works, into which the sewage was pumped, on the Leicester road about half a mile from the town. They consisted of precipitation by lime and filtration through coke beds, but, as the sewerage of the town increased, the river got so polluted that in 1896 the council were compelled to improve their outfall works. They then adopted the international scheme of precipitation by "Ferozone" and filtration through "Polarite" beds, at a cost of £3,250. This answered satisfactorily for a time, but eventually was found to be quite inadequate to deal with the sewage, the description of which was entirely altered by the fatty effluent discharged into the sewers from Messrs. Rust & Company's wool spinning mill, and in 1907 Mr. Midgley Taylor, of the firm of Messrs. Taylor, Sons, & Santo Crimp, of London, was called in to devise a scheme to deal with the matter, and he engineered the present outfall works, for which a loan was obtained for £19,970.

The site of the works, covering an area of 11 acres, is situated outside the urban district, about half a mile from the pumping station. It was therefore necessary to put down new centrifugal pumps, driven by compound steam engines in duplicate, with two new boilers, and to carry from them a 12-in. cast-iron pumping main to the site of the new works; this was done by arrangement with the owners of the lands through which it passed.

The sewage on its delivery is passed into a small chamber, from which it can be led to one or other of the four settling tanks, the combined capacity of which is 214,000 gallons. These tanks are designed with a view to retaining as much as possible of the solid matters of the sewage and to prevent the fatty matters from passing on to the bacteria beds. The sludge which is retained in these tanks can be automatically discharged from the bottoms on to specially-prepared areas of land, where the sludge is dug in or used to manure the land.

The liquid passing from the tanks is then treated by a double series of bacteria beds. The first series consist of double rectangular beds, each 315 ft. long by 45 ft. wide, filled with slag broken to gauge between 2 in. to 1 in., to a depth of about 7 ft., and together contain 7,000 cubic yds. of filtering material. The effluent is discharged on to them by automatic travelling distributors.

The effluent, after passing through the beds, is then discharged into intermediate settling tanks, from which it is carried through circular distributors to the second series of six bacteria beds, each 81 ft. 6 in. in diameter and 5 ft. 6 in. deep, containing in all 6,000 cubic yds. of filtering material, broken to gauge between 1 to ½ in. Part of these were filled with slag and part with granite, the result from each being apparently equally good. The effluent, after leaving the second series of beds, has been so good that it has been found quite unnecessary to further treat it on the land (which is used for growing crops of mangolds and cabbage). It is therefore discharged through open channels into the river. On analysis, as much as 90 per cent of purification has been shown by the treatment, and no complaint whatever has been made of pollution in the river. The works may therefore be considered a great success, but the author is of opinion that the rectangular beds are too wide for the travelling distributors, as they have been a source of constant trouble and expense ever since they were started in 1910, and are still very unsatisfactory.

The works were designed to deal with an estimated dry-weather flow of 350,000 gallons per day, with an allowance for 25 per cent more than the estimated population at the time of construction.

Previous to using this installation the council made arrangements with Messrs. Rust & Company to put down a plant to extract the grease from their wool-scouring effluent before delivering it into the public sewers. This made a great difference to the description of sewage to be treated at the outfall works, and although it is still of a very greasy nature, no difficulty has been found in satisfactorily treating and purifying it.

HOUSE REFUSE AND DESTRUCTOR.

For many years the council collected the house refuse, and in recent years, also the trade refuse, and carted it to a tip in an old brickyard at one end of the town, but this eventually created such a nuisance to the adjoining houses that it had to be abandoned. The council then carted the refuse to a tip at the old sewage works. During this time arrangements were being made for the erection of a destructor; designs and tenders were invited, and the council selected the one submitted by Messrs. Dawson & Manfield, of Manchester; a loan of £2,150 was obtained; it was erected adjoining the pumping station

* Paper presented at the East Midland District Meeting of the Institution of Municipal and County Engineers, held at Melton Mowbray on Saturday last.

at the old sewage works, and started to work in February, 1915.

The destructor is of the back-feed type with two cells, each having an area of 20 sq. ft. of grating, with steam jet blowers for forced draught, combustion chamber and Cornish boiler, the steam from which drives the engines for pumping the sewage. The chimney is 65 ft. high. The two cells are capable of consuming 1 ton of refuse per hour, and the installation is sufficient to pump the whole of the sewage, thus saving a large coal bill, the amount of which has practically paid the working expenses of the destructor. During the summer months there is insufficient refuse from the town to keep the destructor going, but the deficiency is made up from the heap of old refuse tipped on the site.

WATERWORKS.

Up to 1886 the town's water supply was pumped from local wells, but they gradually became polluted, and in that year a scheme of water supply by gravitation was carried out by Mr. Baldwin Latham, at a cost of £8,400. An underground spring was tapped in the neighbourhood of Scalford, about three miles from the town, an adit was constructed to hold 100,000 gallons, which was then a day's supply, and cast-iron mains were laid to supply the town. Although this spring does not now yield as much as it did when first tapped, it has averaged 100,000 gallons per day for some years, and satisfactorily supplied the town until 1900, when a further scheme, engineered by Mr. Baldwin Latham, consisting of gathering drains also in the neighbourhood of Scalford, at a level to gravitate into the town, was carried out at a cost of £12,720. This scheme was calculated to yield a minimum of 100,000 gallons per day, but this was never realised, the yield at times being as low as 20,000 gallons per day. This caused a shortage in the town and necessitated a further supply, which was obtained by gathering drains at a lower level near Scalford village, the water from which has to be pumped into the mains. This supply is only used when required to make up the deficiency from the other two supplies, and the cost of carrying out the work was taken from income.

CATTLE MARKET.

In the old days the cattle markets were held in the streets, but this became such a nuisance that in 1869 the council obtained an Act of Parliament authorising them to expend £4,000 on the construction of a cattle market, with power to claim tolls for everything sold therein. In 1908 a further sum of £3,500 was borrowed for improvements, consisting of a large shed for the sale of pigs and alterations to the cattle and sheep pens and paving, also for the erection of auctioneers' offices, enlarging and improving the slaughter house in the market, and erection of stables near for the council's horses. The market is now a very complete one, and one of the best in the country for a town of the size of Melton Mowbray.

During the past five years the average number of animals offered for sale annually at the weekly markets and fairs has been 9,937 cattle, 5,838 calves, 34,720 sheep, 10,739 pigs, and 466 horses, besides a number of poultry, &c., and, in addition to these, four sales by auction of horses are held each year.

CEMETERY.

In 1892 the council obtained a loan of £3,740 for the purchase of 5¾ acres of land, and laying out 3¾ acres for a cemetery, with chapel and caretaker's lodge, &c., and in 1914 a further sum of £750 was borrowed for enclosing and laying out the remaining 2 acres of the land as an extension to the cemetery; this has now been completed and opened for burials.

FIRE BRIGADE.

The council maintain a fire brigade and possess a manual and steam engine, which are available for fires in the town and district.

ISOLATION HOSPITAL.

In 1904 an isolation hospital for infectious diseases was built just outside the town, at the joint expense of the Melton Mowbray Urban and Rural District Council, in conjunction with the Belvoir Rural Council. This has proved a great benefit, and has no doubt been the means of reducing the number of cases of infectious diseases in the town and neighbourhood.

PUBLIC PARK.

The town boasts of a very pretty public park, with bandstand and playing field, but the cost of this was defrayed from income derived from the estates which the town are fortunate enough to possess.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

PRESSURE FILTERS.

To the Editor of The Surveyor.

Sir,—In your issue of the 8th inst., under that very interesting column "Things One Would Like to Know," some very pertinent questions are asked on the subject of pressure filters, which we, as one of the oldest firms to introduce the intensive or mechanical systems of water purification, can answer in the affirmative.

The present-day mechanical filter is naturally very different from its original forerunner, it being a scientific apparatus, which, when used in conjunction with various chemical reagents, is now generally adopted to purify and render absolutely safe, bright, potable and sparkling, practically every kind of water, no matter how great its discolouration, or its chemical or bacteriological impurity, and in consequence many of the leading engineers of to-day are adopting the intensive or mechanical system of filtration instead of the costly system of open sand beds.

Pressure filters are converting into good potable supplies polluted waters in China (and rivers *are* greatly polluted in China!), the Malay States, Japan, Australia, South Africa, South America, and other places too numerous to mention; while in England hundreds of public and private water supplies are purified by the Candy (or other mechanical pressure filters), millions of gallons of water required for our troops in this country being at the present moment filtered by this system.—Yours, &c.,

The Candy Filter Company.
Frank Candy, Managing Director.

Westminster.
September 21, 1916.

THE BRITISH DECIMAL SYSTEM.

To the Editor of The Surveyor.

Sir,—I see that Mr. E. A. W. Phillips has been extolling the merits of his B.D.S. in your columns. [The Surveyor, September 15th, p. 235.] As lecturer for the Decimal Association, I desire to say that in the present state of progress and standardisation it is not advisable to entertain the idea of two meters, one the universal 39·37 in. and another of 39·6 in. The statement that Gunter's chain is derived from the old Belgic yard of 39·6 in. may be interesting, but the world has adopted the French measurements, and if we wish to regain our standing in foreign markets after the war is over we must quote in the terms of measurement used in those markets. All honour to Mr. Phillips for working out his system, but I am afraid we must call it fantastical. American engineers are insistent in their demand for extended use of the metric system, as stated in the U.S.A. Senate Report on the Metric System in Export Trade issued last January, and it behoves us to "burn our bridges and boats" and for once in a while forget our insularity and be willing to accept the necessity for a reform before it is too late.—Yours, &c.,

J. Lingham Lees,
Author of "Metric Weights and Measures."

Gidea Park.
September 22, 1916.

Light Saving.—As a result of the six months' operation of the Daylight Saving Act, Liverpool consumers for lighting purposes of gas and electricity will find themselves approximately £35,000 in pocket. Of this sum £25,000 has been saved on gas alone. At Bootle the average saving to consumers is estimated at 15 per cent.

The Position of Gas Undertakings.—At a general meeting of the Wales and Monmouthshire Institution of Gas Engineers and Managers held at Aberdare on Wednesday, the incoming president, Mr. J. G. Kenshole, Merthyr, gave an exhaustive survey of the position created by the war in so far as it relates to gas undertakings. The general effect was that the price of gas had to be increased, while no renewals or replacements were being carried out that could possibly be deferred without loss to undertakings. The action of the Board of Trade in increasing the price of coal by 2s. 6d. was characterised as a grave mistake. In conclusion, he said he thought that the demand for gas for lighting purposes would continue to increase.

Passenger Transportation in Large Cities.*

By J. M. McELROY, General Manager, Manchester Corporation Tramways.

Systematic studies of the passenger transportation requirements of the large cities in this country —studies directed towards making proper provision for meeting the constantly increasing traffic demands which follow the cities' development—have not in the past been undertaken with that thoroughness which has been characteristic of many cities abroad, particularly in America.

Looking ahead is not one of our strong points, and certainly preparation for future developments has not been a distinguishing feature in some phases of our local government. True it is that in recent years we have heard much of town planning, but it is doubtful even now whether it is being conceived and directed, except perhaps in a few instances, with that breadth of view which its importance demands.

Town planning schemes and the making of provision for future passenger transportation requirements are really part and parcel of the same problem, and should be considered together. They cannot be divorced if the best results are to follow; and the planning of transit facilities should only be undertaken after detailed studies have been made of each city's traffic characteristics.

That our ancestors gave little or no attention to town planning the older parts of most of our cities only too plainly indicate. The lay-out of the streets followed no plan—they "just happened." In consequence of this the difficulties in the way of providing adequate transit facilities sooner or later becomes one of the most complex questions we have to face.

As cities grow, due to the gradual increase in population, and as the riding habits of the people develop, it becomes more and more difficult to make the channels of passenger transport equal to the ever-growing demands.

In every city the main factors affecting this problem are much the same. There is a constant migration of the population from the inner to the outer zones, and this is greatly accelerated by every extension and improvement in the means of transit. Suburban districts rapidly become urban, and new suburban districts in the outlying areas are always in process of formation. Smaller towns and districts on the outskirts are drawn into closer touch with the cities, and a greater community of interests is being established over a gradually widening area.

Every extension of the means of transit into the outer zones adds to the difficulties of handling the traffic in the central zone, and in time the congestion becomes so acute that the city authorities realise that they are face to face with the inevitable traffic problem. This condition of things arises sooner or later in all large cities, but some cities have been confronted with the problem at an earlier date than others owing to the narrowness and bad lay-out of the streets in the older parts of the city, to the absence of suitable arterial roads, and to the presence in the central zones of a large amount of ordinary vehicular traffic, which, if it is slow-moving, tends greatly to retard the general flow of traffic.

GROWTH OF TRAFFIC.

It is well known that the passenger traffic in cities grows at a much greater rate than the increase in the population. Some years ago a student of traffic questions, having analysed the statistics of a number of European cities, found that on the average the number of passengers carried increases in the same ratio as the square of the population.

This rule is approximately true as regards American cities, but it does not appear to be true as regards British cities. In some of our cities the number of passengers carried is increasing at a much greater rate than the square of the population. . . .

In considering the traffic statistics of various cities it may be very misleading to draw general inferences unless the local circumstances in each case are fully recognised and clearly kept in mind. Many factors tend to accelerate the normal growth in a particular city, and unless we are acquainted with these we may be drawing wrong conclusions from the data. Quite apart from the question of the increased facilities and the introduction of general improvements in the means of transit—which are always followed by a rapid rise in the number of passengers carried—the factor as to the fares charged, and the changes made therein from time to time, has a most important bearing on the subject. We have therefore, in the case of each city, not only to look at the total transit facilities provided, and gauge their excellence or otherwise, but we have to look at the fares charged, and see the effect of these. We should ascertain the extent to which long-distance and short-distance passengers are respectively catered for. In short, comparative statements as to the number of passengers carried tend to be misleading, because they do not indicate the average distance travelled by each passenger.

The ultimate volume of passenger traffic which can be dealt with by facilities which use the street surface is limited by the capacity of the arterial routes near the central parts of the city. When the traffic on these routes approaches the saturation point, then additional arteries must be opened out or other transit facilities provided.

The new facilities which may be provided are:—

(1) Railways—(*a*) in shallow subways; (*b*) in deep level "tubes"; (*c*) on elevated structures.

(2) Shallow subways in the congested areas into which the surface cars can be run.

Many cities have not waited until the saturation point of the surface facilities has been reached before underground or overhead railways have been constructed, because the demand for the railways has arisen through the constant desire for quicker movement. In other words, time saving has been the main factor which has led to the construction of many city railways, and the patronage they receive from the public depends largely upon the time-saving capabilities of the lines.

SUBWAYS.

Experience shows that the provision of shallow subways into which surface cars can be run so as to relieve the traffic congestion in the central parts of cities cannot be justified, owing to the great cost of construction and the comparatively small amount of traffic which can be passed through them.

Underground lines of any description can only be justified by a dense traffic demanding the operation of high-speed trains run at very close intervals.

In planning new transit facilities a wide outlook is all-important. Any schemes carried out on narrow or confined lines, or which do not form part of the transportation requirements of the city, viewed as a whole, ultimately result in serious losses to the community from every point of view.

Underground lines should be so laid out that they can be worked in conjunction with the surface lines by providing suitable transfer points from surface to underground and *vice versa*. The surface lines should gather the local traffic and feed the underground lines, which, in order that they may pay their way, must be provided with an immense volume of traffic.

It is not at all likely, having regard to the general experience, that private enterprise will be willing in future to shoulder the great outlay involved in the provision of underground facilities.

In New York the total outlay on the underground and elevated lines—when the extensions are fully completed—will be £137,000,000. The expenditure on the extensions, undertaken in recent years, will be £68,000,000. This capital is being provided, roughly, half and half by the city and by the operating companies. The companies are to get out of the revenue all their operating expenses and 6 per cent upon their investments, and out of the balance the city is to get the interest on its investment, plus 1 per cent for sinking fund, and if there is any profit after these payments have been made it is to be divided equally between the city and the companies. It is, however, doubtful whether there will be the available net revenue to meet the interest and sinking fund payments of the city, and the possibility of any ultimate profits to the city is remote. But the city authorities are not looking for profits. They are determined to provide adequate travelling facilities—and so important a duty on the part of the municipality do they consider this that they have made up their minds to do it

* From a paper read at the fifteenth annual conference of the Municipal Tramways Association.

properly, even if it entails a charge upon the rates of the city.

In London—where all the capital for the underground railways has been found by private enterprise—it is pointed out by Sir Albert Stanley that in 1913 the amount available for dividends on the ordinary capital was only sufficient to pay just over 2 per cent—not a very encouraging result for a city which has the largest population in the world.

In studying the problem which we are now faced with in Manchester—where several of our arterial routes approaching the centre of the city have practically reached the saturation point—I came to the conclusion, after careful consideration, that the proper course for the corporation to pursue to meet the constantly-growing requirements was—before attempting to provide underground facilities, the cost of which is so enormous—to improve and make more efficient the existing surface lines by opening out parallel routes, by forming new streets and widening others at considerable cost, and also by adopting tramway terminals near the heart of the city, the latter being necessary on account of the narrowness and bad lay-out of the central streets.

Since my report was written, I observe that Mr. M. C. Brush, the vice-president of the Boston Elevated Railway Company—a company which operates the whole of the transportation facilities in Boston *i.e.*, the surface tramways, tramways in subways, underground and elevated railways—made the following observations in a paper read before the American Electric Railway Association in 1916:—

"When tracks in a certain street have reached the saturation point . . . and additional transportation facilities must be provided, every conceivable effort should be made to use parallel streets for additional surface tracks, or even build an elevated structure. It is absolute economic waste recklessly to spend enormous sums of money for subway construction merely because a particular highway has operating upon it all the surface cars consistent with either good transportation or economy, and subway construction should only be decided upon after other and less expensive means of furnishing additional transportation have been sufficiently studied to justify their expediency.

"The enormous amount of traffic absolutely necessary to support expensive subway construction makes it incumbent on those responsible for such expenditure to thoroughly satisfy themselves that the traffic offered, and the conditions prevailing, compel subway construction rather than the use of other arteries on the highway or even private right of way construction on the surface."

The necessity of utilising the streets to the fullest advantage for meeting the demands for passenger transportation involves the consideration, from time to time, of the question as to the most suitable means of surface transit, having regard to the traffic requirements.

TRAMCARS OR MOTOR 'BUSES.

Much has been written about the relative merits of tramcars and motor 'buses—unfortunately not without bias on the part of the advocates of each class of vehicle.

An abstract discussion as to the relative merits of tramcars and motor 'buses, without reference to the particular purpose for which they are intended to be used, is likely to be very misleading. Each type of vehicle has its peculiar advantages, and in the future each will be utilised for handling that class of traffic for which it is best suited. The tramcar, on account of its greater seating capacity and its ability to cope with traffic of a widely fluctuating character, will be utilised where heavy peak loads have to be catered for. On the other hand, where the volume of traffic is not great, or where there is a steady traffic flow throughout the day, motor 'buses will probably prove to be the more suitable vehicles. In some instances it may be found to be advantageous to run the two types of vehicles along the same routes.

The aim should be to use the highways as channels for passenger transport to the best possible advantage, and the most efficient means of doing this can only be decided upon in any particular case by a study of the traffic characteristics.

Attempts have been made to show the relative efficiency of the two types of vehicles—tramcars and motor 'buses—by comparing the average loading. It has been pointed out that "the average load of a tramcar with seventy-four seats is 10½ passengers, and of the motor 'bus with thirty-four seats is eight passengers, and therefore the relative efficiency of the motor 'bus is almost twice as great as that of the tramcar."

This is a distortion of the meaning of the word "efficiency." In practice we have not to deal with hypothetical averages, but with actual traffic conditions—conditions often varying greatly at different times of the day. The relative efficiency of the two types of vehicle cannot otherwise be gauged than by their ability to cope with the volume and flow of traffic in particular cases. . . .

Sir Albert Stanley, in his paper, points out that:—

"The motor 'bus, when operating in conjunction with other means of transit, has not a peak load. One reason is the absence of workmen's return fare, which cuts it off from a fair share in the traffic before eight o'clock in the morning. Another reason is the smallness of the units required to be filled with traffic, which allows of a closer adjustment to demands. A third reason is the special feature of motor 'bus traffic casually picked up all day long, so long as there is traffic in the street. The motor 'buses are always reasonably full throughout the day. At the time of peak load they are quite full."

The opening sentence and the last sentence of this quotation put the facts very frankly—at the rush hours the motor 'buses are quite full, but the other transit facilities are looking after the peak loads. . . .

RUSH-HOUR TRAFFIC.

The making of proper provision for handling the rush-hour traffic will always be the difficult part of the passenger transportation problem. It involves, and will continue increasingly to involve, a large expenditure of capital and comparatively high operating costs.

It is on account of this that competition by separate companies for the steady all-day traffic by means of vehicles which can be run on the public streets at a relatively small capital cost, and which escape many of the obligations placed upon those who cater for the peak loads, is unfair, and should not be permitted.

The right to operate public service vehicles, acquired by merely obtaining an annual licence, is archaic, and new legislation dealing with this matter is urgently needed. Concessions to use the public streets, if granted, should carry with them obligations in the public interest, with corresponding security and protection for the operators.

It is becoming more and more clearly recognised by all those who are qualified to judge that the public interests are best served by making the facilities for city passenger transportation a monopoly—a monopoly subject to the control of the city authorities, who should possess full powers either to provide and operate the facilities themselves, or, if they think fit, to grant franchises to private companies to do so, subject to control and regulation in the public interest.

The world's experience has shown that every city should have a permanent authority directing the initiation and carrying out of all schemes for new transit facilities, in order that there may be continuity of policy, and that the future needs of the city and the surrounding districts over a wide area may be properly looked after.

Municipal Officials' War Allowances.—The Finance Committee of Southwark Borough Council have reported to that body with reference to the war allowances made to their employees. A question had been raised as to the legality of the council's action in paying allowances, and, pending the decision of the district auditors, the council decided that certain payments should be withheld. Then came the passing of the Local Government (Emergency) Provisions Act, 1916, and, in view of all the circumstances, the town clerk was instructed to place all the facts before the Local Government Board, and to ask their sanction to the continuance of existing arrangements. A letter has now been received from the board to the effect that, for the purposes of a sub-section of the Act referred to, Mr. Long would not regard as reasonable the payment by local authority to an employee of an allowance the amount of which, together with naval or military pay and allowances, exceeded by more than 25 per cent the amount of the employee's remuneration. The board have, therefore, sanctioned the continued payment of the present allowances so far as they came within the limit indicated. Instructions have been given for the necessary adjustment in the few cases affected, and as a result the amount paid in allowances will be reduced by £133 a year.

Law Notes.

Edited by J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of The Surveyor, accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed. All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—*i.e.*, without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.

Insufficient Water-closets and Ashpits, Sec. 36 of the Public Health Act, 1875.—"Ynys" writes: Notices (twenty-eight days) under sec. 36 of the Public Health Act, 1875, were served upon the owners of houses within this urban district to provide sufficient water-closets (supply of water and fittings to existing water-closets) and ashpits (covered ashpits, or in lieu thereof galvanised iron bins with handles and lids), on November 19, 1916, and upon subsequent reports by the surveyor that the necessary sanitary improvements had not been completed, the clerk wrote the owners on January 18th, intimating that the council had resolved to carry out the work, and would proceed therewith at the expiration of fourteen days. On April 20th tenders were invited from local contractors. No tenders having been received, the surveyor was instructed to submit an estimate of the probable cost of the sanitary works in each case for the consideration of the Health Committee, and at a meeting of the latter committee held on September 1st it was resolved that the surveyor's estimate be accepted, and that the clerk notify the owners thereof. It has afterwards occurred to me, having regard to the length of time expired since the date of the notice—namely, about nine months—that the council could not legally recover the cost of the sanitary works, and I shall be glad if you will kindly advise what length of time the notice to execute the works will hold good whereby the council could recover the cost of the works by summary proceedings.

Under sec. 257 of the Public Health Act, 1875, in all summary proceedings by a local authority for recovery of expenses incurred by them in works of private improvement, the time within which such proceedings may be taken (*i.e.*, six months from the time when the matter of complaint arises) is to be reckoned from the date of service of a demand for payment, quite irrespective of the date of the notice to do the work; and there is *no* limitation of time within which a demand must be made (*Wortley* v. *Vestry of St. Mary, Islington*, 51 J.P., 166).

Injury to Surface of Highway by Studs in Horseshoes.—"Cumbrian" writes: I have recently laid down on one of my chief roads in place of a water-bound road surface a bituminous compound surface. It is slightly slippery during frosty weather and in summer during wet weather. Some of the owners of horse traffic, to prevent their horses slipping, attach a stud or sharp to the shoes. The fixing of this stud is quite customary in winter, but not in summer. In summer the bituminous surface in fine weather is not at all slippery, but soft, owing to the heat. Notwithstanding the surface being soft, the owners of the horse traffic persist in summer time in fixing their sharps or studs to the horses' shoes and damaging the bituminous surface, though I have pointed out the damage and requested them to discontinue the use of the studs. Have I any legal remedy to enforce the discontinuance of the studs or sharps being fixed to the shoes and used on the roads, water-bound or bituminous? The owners of the horse traffic reply that it is not the bituminous surface on which the horses slip the most, but a length of tar-macadam on a gradient of 1 in 20, joining to the bituminous length, upon which the horses slip both in summer and winter, and that they cannot be expected to stop and take the studs out of the horses' shoes before going over the bituminous section of the road. I may say that the bituminous section is a flat gradient.

If the injury caused to the surface of the highway by the use of the studs is so serious as to amount to a public nuisance, proceedings could be taken against the parties liable, either by indictment or (with the concurrence of the Attorney-General) for an injunction.

Building By-laws.—"Bon Accord" writes: Additions "and alterations" to old buildings, which buildings were erected previous to by-laws being in force in the district, are being carried out. I forward a copy of our by-laws, and shall be glad to have your opinion on the following points: (1) Substantial additions—*i.e.*, three rooms, &c.—being erected to a building "dating back from two to three hundred years," including drains, &c., for which plans have not been submitted. Am I right in my contention that plans should be submitted? By-law 95 refers to "alteration," which I contend does not include additions, as referred to above. (2) If in your opinion plans need not be submitted under this clause, does 88 apply, "Every person who shall intend to erect a building"? &c. Any case bearing on the point in question will greatly oblige.

(1) Inasmuch as no by-laws were in force when the building was erected, plans of the additions cannot, in my opinion, be required under By-law 95. The question whether the term "alter" includes the making of additions is not material, since, if it does not, this by-law would not apply even had by-laws been in force when the building was erected. (2) By-law 88 applies only if the additions and alterations constitute the erection of a new building. Under sec. 159 of the Public Health Act, 1875, the alterations therein specified are to be considered as the erection of a new building. And in districts in which sec. 23 of the Public Health Acts Amendment Act, 1907, is in force, the operations therein mentioned are to be deemed to be the erection of a new building. In cases not covered by these enactments it is a question of fact, to be decided by the magistrates, whether the operations constitute the erection of a new building; see *James* v. *Wyvill* (48 J.P., 725). The following cases are in point: *Shiel* v. *Sunderland Corporation* (25 J.P., 647); *Hobbs* v. *Dance* (38 J.P., 56); *Lee* v. *Barton* (73 J.P., 509).

Housing, Town Planning Act, 1909: Closing Order.—"Ynys" writes: My council has resolved that a closing order, sec. 17 (2) of the Housing, Town Planning Act, 1909, be made in respect of a certain house within the district, which the medical officer of health reported is so dangerous or injurious to health as to be unfit for human habitation, and that notice thereof be served on the owners forthwith. The house referred to is owned by a local firm of ironfounders, comprising two persons, and I shall be obliged if you will kindly advise whether it is obligatory to serve notices accordingly on each person.

The notice must be served on *both* owners. See subsection (3) of sec. 17, which requires notice to be served on every owner. Inasmuch as this Act is to be construed as one with the Housing of the Working Classes Acts, 1890 to 1903, service may be effected by registered post, as provided by sec. 13 (1) of the Act of 1903.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Droylsden U.D.C. (September 20th. Mr. P. M. Crosthwaite). - £1,751 for the provision of humus tanks at the sewage disposal works.—The clerk to the council, Mr. Geo. Smith, stated that the object of the inquiry was to enable the Local Government Board to be in a position to give sanction for the work at the expiration of the war. The loan was asked for a term of thirty years.—The surveyor (Mr. C. Hall) said the Mersey and Irwell Rivers Committee had brought to their knowledge the advisability of further treatment of the sewage to take out the solid portions. Everything at the works was in a satisfactory condition, except that there was a fairly large amount of suspended matter in the effluent.

APPLICATIONS FOR LOANS.

Wigan T.C.—£11,038 for electric cables, transformers, and switchgear.

Cork R.D.C.—£1,000 for water supply extensions.

LOANS SANCTIONED.

Luton T.C.—£14,474 for the electricity undertaking.

Crompton U.D.C.—£8,729 for works of sewage disposal.

FORTHCOMING INQUIRY.

OCTOBER.	£
5.—**Weston Favell.** For the provision of a burial ground (Mr. P. M. Crosthwaite)	536

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aberavon T.C.—A proposal has been approved for the conversion of the old gas-engine house into a mortuary.

Fulham B.C.—The Electricity Committee recommend that repairs and alterations should be carried out at the electricity works, at an estimated cost of £1,000.

Norwich T.C.—A site has been purchased in St. Stephen's Back-street for an electricity sub-station.

Swanage U.D.C.—The surveyor, Mr. W. H. Pearce, has been instructed to prepare a plan and estimates for a public convenience in the recreation ground.

HOUSING AND TOWN PLANNING.

Edinburgh T.C.—The Town Planning Committee report the completion of the revision of the town-planning scheme for Craigentinny. This will include a wide road from Duddingston to Seafield, and several roads branching off to the Lothian coalfields. The committee are now engaged on the Murrayfield, Ravalston and Comely Bank areas.

Hebburn U.D.C.—Instructions have been given for the preparation of a housing scheme.

MOTOR TRANSPORT.

Barnsley T.C.—The question of the purchase of a new fire engine is engaging attention.

Bolton T.C.—It has been agreed to purchase a motor ambulance for the fire brigade department.

Burton-on-Trent T.C.—The borough surveyor, Mr. G. T. Lynam, has received instructions to make inquiries with respect to motor fire engines.

Lambeth B.C.—The borough council have sanctioned the purchase of a third motor-sweeper.

Mansfield T.C.—The town council have adopted the recommendation of the Health Sub-Committee to purchase a 2-ton electric wagon from the General Vehicles Company, for the sum of £1,070.

Sheffield T.C.—A second-hand motor car is to be purchased for the cleansing department.

Sleaford U.D.C.—It is proposed to purchase a motor lorry.

Southampton T.C.—The Wharf Sub-Committee are making inquiries concerning motor-sweepers.

Tynemouth T.C.—The Watch Committee are considering the purchase of a motor fire engine.

ROADS AND MATERIALS.

Acton U.D.C.—An intimation has been received that the Road Board have agreed to pay 70 per cent. of the cost of widening Willesden-lane (£10,250), and will also lend the council, free of interest for seven years, the sum they will be called upon to pay for their share of the work.

Aspatria U.D.C.—Upon the suggestion of the surveyor, Mr. J. Berwick, the council have agreed to paint the lamp-posts white during the winter, and to whiten the kerbs at crossings.

Axminster R.D.C.—A tender for steam rolling at 30s. per day has been accepted.

Barnsley T.C.—Application is being made to the Local Government Board for authority to make by-laws under sec. 157 of the Public Health Act, 1875, as extended by sec. 23 of the Public Health Acts Amendment Act, 1890, with respect to the paving of yards and open spaces common to two or more dwelling-houses.

Brighton T.C.—Owing to war economies the town council have deferred as much road work as possible, but the heavy motor 'bus traffic has so broken the surface of Bristol-road that an immediate expenditure of £500 on repairs is necessary. The borough surveyor, Mr. H. Tillstone, reports that economies in other matters will cover this outlay, and an effort is to be made to utilise some of the old material.

Kinghorn T.C.—A sum of £100 has been provided in the estimates for the purchase of a tar-sprayer.

Nairnshire C.C.—It has been resolved to make a claim upon the Road Board in respect of the damage of the roads in the Strecus district, the repairs of which are estimated to cost £239. The military authorities will be asked to supply men for the work of restoration.

Rochdale T.C.—Consideration is being given to a proposal to widen Milnrow-road, at an estimated cost of over £8,000.

Steyning West R.D.C.—The surveyor, Mr. F. Slaughter, reported on a recent conference at Horsham with respect to the question of a charge for the use of new routes by motor 'buses. It was stated that the suggested charge of 3d. per 'bus mile was considered too much, while there was an opinion that heavy motor lorries and such-like should also come under the same order.

Swanage U.D.C.—Back-road, Institute-road, is to be made up, and will be taken over by the council when the work is completed.

Taunton T.C.—The borough surveyor, Mr. D. Edwards, reports that the work of surface tarring has been carried out at a cost of 1½d. per super. yard.

SEWERAGE AND SEWAGE DISPOSAL.

Atherton U.D.C.—It is proposed to lay a sewer from Grosvenor-street to the junction of Naylor-street and Cambridge-street, at an estimated cost of £180.

Blean R.D.C.—The surveyor and engineer, Mr. F. A. Ward, reported that the total expenditure on the Herne and Reculver sewerage works was £21,383, an excess upon the estimate of £3,455. It was explained that the cost of labour and materials had risen. The council passed a vote of thanks to Mr. Ward for the able manner in which he had carried out his duties in connection with the scheme.

Bridport T.C.—It is proposed to carry out sewer renewal works, at an estimated cost of £200.

Colwyn Bay U.D.C.—The council have agreed to construct the sewer in Marine-drive for the owners, who have undertaken to meet the cost of the work.

Heywood T.C.—Certain sewerage works have been approved, and the borough surveyor has been instructed to prepare plans for further sewer extensions.

Langholm T.C.—In a report upon the pollution of the River Esk by sewage, Mr. R. H. Bicknell, of London, advises the installation, as an "ordinary" scheme, of certain preventive works, at the cost of each manufacturer in Langholm, having for their object the removal of grease, &c., from the polluted trade effluents before they are allowed to be discharged into the burgh sewers; and that a tank settlement, without chemicals, be introduced at the expense of the burgh. In regard to an "additional treatment" scheme, he states that it should be a complete scheme of purification on standard lines. The estimated costs of the two schemes at pre-war and war prices are: First scheme, £4,809 and £6,485; second scheme, £11,619 and £15,749. This report will come before all the parties concerned, and it is expected will result in a satisfactory settlement.

Midsomer Norton U.D.C.—The scheme of sewage disposal prepared by the surveyor, Mr. C. H. Sutherland, has been approved, and will be submitted to the consideration of a consulting engineer.

Norwich T.C.—The city council decided last week to consider in committee a report of the Sewerage and Irrigation Committee, on the subject of the disposal of sewage sludge. The committee proposed to accept the offer of Wet Carbonising, Limited, to treat the whole of the sludge passing through the sewers from a date within two years from the date of the signing of peace, and also to purchase, at an estimated cost of £1,285, part of the plant of the Norwich Natural Manure Company, Limited. In moving the report, the chairman of the committee, Mr. C. Horner, said the committee, after much investigation and deliberation, believed the patent process of Wet Carbonising.

Limited, to be the only one known at the present time satisfactorily to deal with the sludge problem of the Norwich sewage. This company was willing to undertake the work on the terms set forth in the report, and to give the corporation security for the money advanced to purchase of the Natural Manure Company that part of their machinery at their Whitlingham works which Wet Carbonising, Limited, desired to retain, and to repay this amount by instalments bearing interest at 6 per cent. He might add that the work done by the Travis tanks had always been satisfactory, and fulfilled the expectations of the committee and the engineer.

St. Austell U.D.C.—It has been agreed to erect two shafts in South-street to ventilate the main sewer, at an estimated cost of £20.

Seaham Harbour U.D.C.—The surveyor, Mr. F. E. Boaz, has prepared the draft of a scheme for the prevention of flooding in the southern district, and for sewerage extensions, which will be considered by the Health Committee.

Wayland R.D.C.—The council have authorised the Watton Parish Council Committee to carry out the proposed work at the sewer outlets, and also provide additional filter beds.

WATER, GAS, AND ELECTRICITY.

Ballycastle R.D.C.—Complaint having been made of the serious shortage of water, it has been decided to construct a reservoir, at an estimated cost of £800.

Bath T.C.—The Surveying Committee have approved a recommendation of the Street Lighting Sub-Committee refusing the demand of the Bath Gas Company for payment in respect of street lamps which had been put out of lighting. The chairman of the Surveying Committee, Councillor Wills, stated that the gas company, under their last contract, had asked to be relieved of that portion of lighting which they said was unremunerative—the actual lamp lighting. This was done and the work undertaken by Horstmann's. The company thereafter supplied the corporation with gas at the current rate in the town. In other words, the corporation became ordinary consumers. Now the company was asking the committee to pay 11s. per lamp for the lamps put out of lighting, but the committee felt that they should not be treated as other than ordinary consumers.

Lincoln T.C.—A benzol recovery plant is to be installed at the gasworks, at an estimated cost of £2,000.

Matlock Bath U.D.C.—Owing to the increased cost of materials, the council have decided to raise the price of gas on October 1st, 2d. per 1,000 ft. to ordinary consumers, and 3d. per 1,000 ft. to slot consumers.

Nuneaton T.C.—It has been agreed to adopt the high-tension three-phase alternating current system for the supply of electricity. The estimated cost is £2,100.

Paignton U.D.C.—Inquiries are being made by the clerk as to the probable cost of easements for the proposed duplication of the water-main.

Penzance T.C.—For the purpose of supplementing the water supply, the town council have hired a pump and oil engine, with the option of purchase, in order to pump water from the borehole at Hendra. The price of the pump is £185, and of the oil engine £54.

Southwick U.D.C.—The council have resolved to give notice to the Board of Trade of objection to the proposal of the Brighton and Hove General Gas Company to substitute a standard of calorific power for the existing standard of illuminating power.

Spenborough U.D.C.—Mr. G. I. Talbot, K.C., arbitrator in the proceedings between this council and the Bradford Corporation, relative to the price to be paid by Spenborough for a water supply in bulk from the corporation, has given an award of 7d. per 1,000 gallons.

Swanage U.D.C.—The surveyor, Mr. W. H. Pearce, has been instructed to prepare a scheme for the improvement of the water supply.

Torquay T.C.—The price of electricity will be increased from 4½d. to 5d. per unit.

Upholland U.D.C.—The Local Government Board have written that the council's scheme for laying a water-main from Stephen's No. 1 shaft, Roby Mill, to the reservoir in Mill-lane was generally satisfactory, but a loan for the expenditure involved, £1,800, could not be sanctioned at present.

Waterford T.C.—Sanction has been obtained to the borrowing of £1,000 to meet the preliminary expenses in connection with the scheme for electric lighting.

MISCELLANEOUS.

Brighton T.C.—In reference to the proposal of the town council to apply for a provisional order, authorising them to work general motor-omnibuses on any route, the Local Government Board state that they do not propose to entertain further applications of the kind by way of provisional order; but they suggest an arrangement which would enable the corporation to lease the right of user, and also extend the period for carrying out the railless traction scheme sanctioned in 1912.

Ilkeston T.C.—The town council have disposed of their electricity and tramways undertakings to the Nottinghamshire and Derbyshire Tramways Company for the sum of £28,150.

PERSONAL.

Mr. R. G. Coles, borough surveyor of Wilton, has resigned on account of ill-health.

Mr. D. H. B. Stevenson, surveyor to the Leake Rural District Council, has been passed for garrison duty abroad.

Mr. Thomas L. Brown, burgh surveyor of Arbroath, has been granted a commission in the Royal Engineers.

Mr. A. Wilson, surveyor and sanitary inspector to the Ashburton Urban District Council, has had his salary increased by £20 per annum.

Mr. N. N. Royston, the highways foreman, has been appointed surveyor of buildings to the Driffield Urban District Council, in succession to Mr. J. Berry, resigned.

Mr. William R. Raban has consented to act as deputy surveyor to the Baldock Urban District Council, in the absence on military service of Mr. Philip Kent.

Mr. E. G. Whitcombe, formerly assistant surveyor to the Chipping Sodbury Rural District Council, who has been on active service, has been reported "missing" since September 1st.

Mr. J. Williams and Mr. J. Prisk, highway surveyors to the Halston Rural District Council, have been granted an increase of salary of £13 a year each for the duration of the war.

Mr. E. Whitwell, surveyor to the Abersychan Urban District Council, has received an important appointment under Government. There were 300 competitors for the position, and the council have offered their congratulations to Mr. Whitwell upon his success.

OBITUARY.

Mr. W. Hodgson, who was for many years surveyor to the Keswick Urban District Council, died recently, we regret to state, in his seventieth year. At the meeting of the council a resolution was passed expressing appreciation of the valuable services he had ungrudgingly rendered to the community during the past thirty-seven years.

FOR OTHER ADVERTISEMENTS
See End of Paper.

SALE OF PLANT.

METROPOLITAN BOROUGH OF SOUTHWARK.

Offers are invited for the purchase of any of the following Plant (superseded by motor traction):—

A. 4. Circular Iron Tanks on Wagons.
For road washing purposes (approximate capacity 600 gallons).

B. 4. Rotary Machine Brooms.

This Plant may be viewed between the hours of 10 a.m. and 4 p.m. on any week-day except Saturday, on application to the Borough Engineer and Surveyor.

Offers will be received until 10 a.m. on Friday, the 13th day of October, by the Town Clerk, Town Hall, Walworth-road, S.E., and must be endorsed "Offers for Plant."

The Council does not bind itself to accept the highest or any offer.

Town Hall,
Walworth-road, S.E. (3,113)

STEAM HAULAGE.

Flaxton, Yorks., Rural District Council have adjourned for two months the consideration of a report by the surveyor, Mr. J. W. Lupton, on the subject of steam haulage.

Mr. Lupton's report stated that by the purchase of a 5-ton steam tractor and two tipping wagons, 30 to 40 tons could be hauled daily, at a cost of 10d. per ton, effecting a saving of £385 8s. per year. His calculation included wages of driver, two men for filling, and 12½ per cent. for repair and depreciation. The cost of team labour for the five years past had shown an average of £779 16s. The cost of hauling by tractor of 10,000 tons would be £416 13s., a saving of £363 3s. With a tractor, the stone could be led to the roller and tipped ready for spreading. This would effect a further saving in labour, which he estimated at £111 5s. A horse would be required for the water-cart for, say, 200 days, at 9s. per day. He had prepared the following figures as showing the comparative costs: Estimated cost of haulage by tractor, £416 13s.; horse for water-cart, £89; total, £505 13s.; as against average cost of team labour for the past five years of £779 16s. The saving on haulage would be £274 3s., and the saving in roller gang £111 5s., making a total saving of £385 8s. He had estimated the cost of this year's team labour to amount to £950, £170 above the average during the previous five years. This did not include any team work on the local camp roads. The average cost three years ago was 1s. 8¼d. per ton; this year it would be 2s. 1¼d. During the past two or three years it had been impossible to get carts to carry stone in such quantities as to keep the roller at work, and this had resulted in a great loss of time in moving to various parts of the district. The price of tractor and two wagons would be £720, but this amount would be saved in two years.

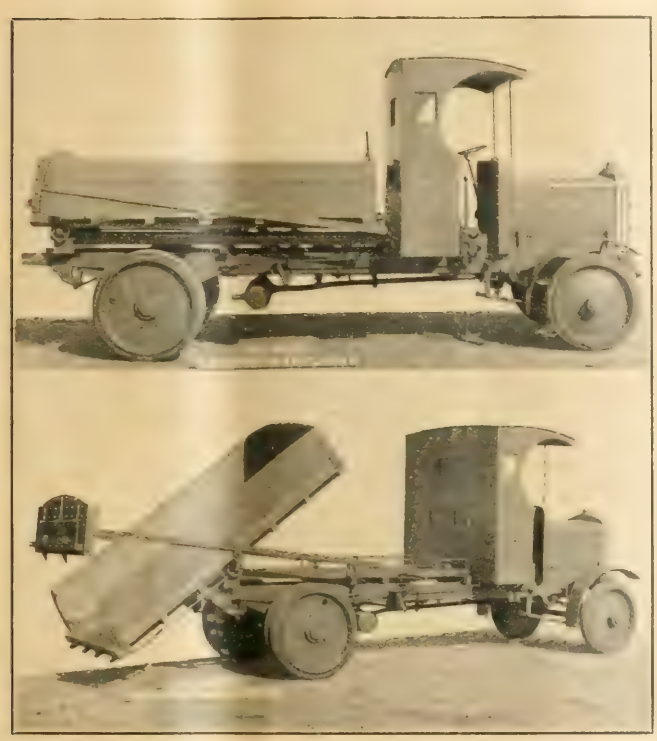
The Widening of Leadenhall-street.—The London County Council have agreed to pay half the cost of a further widening of Leadenhall-street, to be carried out by the City of London Corporation.

STRAKER-SQUIRE PATENT TIPPING WAGON.

In the patent tipping wagon illustrated herewith the automatic action of the rear end of the body in relation to the tail door is a notable feature. During the operation of tipping, the raising of the front end of the body causes the rear end to be released from the tail-board, which remains in its normal position, and thus allows a free outlet for the material.

The simplicity of the tipping gear will be apparent when it is stated that the tipping and discharging of the heaviest loads can be effected in a minute and a half, and the general construction of the vehicle is such that the load is evenly distributed over both front and rear axles.

This tipping wagon, which is British made throughout, is fitted with a 45-h.p. motor, and is intended to carry a nett load of 5 tons, excluding weight of body-work.



VIEWS SHOWING OPERATION OF STRAKER-SQUIRE PATENT TIPPING WAGON.

The general dimensions of the chassis are as follows: Overall length (over starting handle), 20 ft. 1 in.; overall width, 7 ft. 1¾ in.; wheel base, 13 ft. 6 in.; wheel gauge to centre of tyres, 5 ft. 9¾ in.; length from dash to rear of frame, 15 ft. 3⅞ in.; length from dash to centre of back axle, 11 ft. 2⅜ in. The frame is strongly constructed of pressed steel, ¼ in. thick, well braced together with transverse members of pressed steel, united by ample size gusset plates, which are solid with the cross members. At centre of side members frame is 8 in. deep. The engine is of the four-cylinder type, the cylinders being cast in pairs, 120 mm. bore by 140 mm. stroke. The inlet and exhaust valves are all located on the same side of the cylinders, and operated by one camshaft. The road wheels are of cast steel, standard sizes, and are suitable for fitting 1,030 by 140 mm. twin tyres on back, and 900 by 140 mm. single tyres on front for 850 rim fitting. The standard size of platform is 12 ft. by 6 ft. 6 in., but this can be exceeded if found necessary up to 15 ft. by 7 ft.

Readers desiring further particulars with regard to this vehicle should communicate with Messrs. Straker-Squire (1913), Limited, Nelson-square, Blackfriars, London, S.E.

HIGHWAY MAINTENANCE AT TIVERTON.

Mr. J. Siddalls, borough surveyor of Tiverton, states in his report for the year ended March 31st last that, in spite of difficulties arising from shortage of staff and horses, and scarcity of materials, the highways under his charge were maintained during that period in a good state of efficiency. A longer stretch of roadway than hitherto was tar surfaced, with excellent effect, both in dust prevention and protection of the road surface.

The surfaces of all the main thoroughfares, and some of the side streets, were tarred. On the latter, which were not watered, the coating is still in existence, and will not have to be renewed this year, which, Mr. Siddalls observes, tends to prove that the tarring is valuable in preserving the metalling from wear and tear.

The cost of maintenance per mile was for main roads £93 6s. 10d., and for other roads £23 13s. 10d.

MUNICIPAL ENGINEERING WORK AT CAPE TOWN.

CITY ENGINEER'S REPORT.

Reference is made in the last-issued annual report of the city engineer, Mr. D. E. Lloyd Davies, M.INST.C.E., to a scheme for the main drainage of the southern suburbs of Cape Town.

The scheme, which deals with an area of approximately 30 square miles, is divided into two portions, and provided for 74 per cent of Woodstock and 11 per cent of Mowbray to gravitate to the Flash Light, Green Point, through the Cape Town sewers, and the extension of the existing ocean outfall. The remainder of the sewage of Woodstock and Mowbray and the drainage areas of Maitland, Rondebosch and Claremont, as they existed prior to unification is to be conveyed to a pumping station at Mowbray, and then lifted to the purification works on the municipal land situated on the Cape Flats, and known as the T.T. Lands. This ground is conveniently placed for taking the added areas of Rondebosch and Claremont, and its position, central to the whole area to be drained, reduces the length of large sewers to the minimum.

The estimated cost of the work, including all charges, is £489,000, and £496,000 if the whole of the sewage is conveyed to the Cape Flats.

WATER SUPPLY.

Mr. Lloyd Davies mentions that special committees have been appointed to deal with the augmentation of the water supplies of the city and that some progress has been made. It is hoped, however, in view of the increasing consumption and the drainage work contemplated in the suburban areas, that this important necessary work, which has engaged so much attention in the past, will assume more tangible form in the near future.

SCAVENGING.

In the Cape Town district approximately 55 miles of roads and footpaths—about two-thirds—are swept daily, and in the period under review 66,896 loads of sweepings were collected and removed at a cost of £7,956. Most of the refuse collected from the streets is composed of fallen leaves, and the quantity becomes greater each year, owing to the growth of the trees.

Street gullies are cleansed at night, a section of the town being taken nightly. Many of the gullies are constructed on the dip-stone principle, and many are directly connected with the sewer. The sealing of trap gullies is therefore practically useless, as in many cases the gully on the opposite side of the street is untrapped and directly connected to the sewer, also the sewer covers are perforated. Many of the trap gullies are 4ft. and 5 ft. deep, and the bottoms are box-shaped and not easily cleansed.

Collections of house refuse are made daily in the city, with the exception of Sundays, commencing at 6 a.m. in summer, and daylight during the winter months. Endeavours are made to remove all refuse in main thoroughfares at an early hour, before 8.30 a.m. It is not, however, possible to carry this out universally, as many shopkeepers live in the suburbs and arrive in the city at 9 a.m. and afterwards, and require their refuse to be removed. This necessitates a second collection in busy thoroughfares.

Fully 90 per cent of householders are using insanitary paraffin tins for refuse receptacles, and these have jagged edges, rendering them dangerous to handle, besides which the contents are dislodged with difficulty.

The total quantity of house refuse collected and conveyed to the depot was 43,991 loads, and the cost of removal was £5,026. Assuming the population of the city to be 77,000, the approximate amount of refuse per head for the year would be 0·57 cub. yd., and the amount collected per house 4·08 cub. yds.

STREET WATERING.

The whole of the streets in the city are watered for a period of approximately six to seven months in the year—viz., from October to April. The main thoroughfares receive attention throughout the year. On dry days during the winter months the climatic conditions existing in Cape Town necessitate much care and watchfulness in order to minimise the dust nuisance. Often on a dull and calm day, even when rain is threatening, south-east or north-west winds suddenly rise with extreme violence and soon the city is enveloped in dust. Every available water wagon is then utilised and despatched, but some time necessarily elapses before all the streets are watered.

In summer streets are watered twice daily owing to the incessant traffic. In two thoroughfares which are much exposed to south-east winds it is necessary to water at least four times daily. Salt water, the city engineer states, has proved very efficient in allaying the dust on macadamised roads, but when used for flushing paved streets leaves a dark and unsightly stains.

WATER PURIFICATION IN THE MALAY STATES.

(From a Correspondent.)

The Kuala Lumpur Rubber Company have recently shipped to the Malay States a mechanical pressure filter plant for dealing with the water supply obtained from swamp wells on their estates.

The plant has been supplied by the Candy Filter Company, Limited, of Westminster, London, together with apparatus for automatically adding a solution of sulphate of alumina to the unfiltered water, and a quantity of the powerful oxidising and purifying material "Polarite," which will be used in conjunction with silica sand and grit, to ensure the highest degree of purity.

Candy filters are the only mechanical filters in the market that contain the special purifying material "Polarite," in addition to a filtering-bed of silica sand, &c. "Polarite" is a specially prepared and granulated black magnetic oxide of iron in a microscopically porous condition; it is rustless, and has proved to be a most powerful oxidising and purifying material.

The late celebrated scientists Prof. Sir Henry Roscoe and Sir Edward Frankland made exhaustive trials with "Polarite," and reported it to be a highly valuable material for the purification of water. Many other scientists have also, after long investigation, formed the highest opinion of "Polarite," of which the Candy Filter Company are the sole manufacturers and owners, "Polarite" being the invention of Mr. Frank Candy, the managing director of the company, who has had upwards of twenty years' practical experience in water purification, and for it received the highest award of the Royal Sanitary Institute of Great Britain.

A large quantity of "Polarite" was recently shipped to the West Coast of Africa, at the order of the Crown Agent for the Colonies, for the purification of a water supply in Nigeria.

ROAD MAKING IN SOUTH AFRICA.

(By a Correspondent.)

The most important member of a road-making gang in South Africa is the "boy" who sets off the dynamite. He receives extra pay—3s. a month—and has the right to the snakes, numbers of which are found dead in the rocks after a charge has been let off. The snakes' gall is valued as medicine, and there is big demand for the reptiles by the other boys.

The red-letter day in the life of the gang is pay-day. When this comes round, the boys' eyes are constantly wandering away to the end of the road, and as soon as the clerk appears in sight a shout goes up that echoes again and again. No returning warrior ever had a more triumphant reception than that given to the pay-clerk. The boys line up on the road and clash their picks and shovels and cheer as he rides in.

The neighbouring kraals brew beer for the pay-day, and in some cases a trader sends his mule-wagon over to carry the boys to the store. It is perhaps unnecessary to mention that he does not provide it again for them to return to camp. Kaffir names are unpronounceable and "unspellable" to a white man, but every man's name has to be on the pay-sheet and has to be "crossed" with his mark—a consequence of this being that paying out is a lengthy proceeding.

There are always plenty of applicants for work, but care has to be exercised in not employing men of antagonistic tribes. Men newly engaged will sometimes, after working for a couple of days, send their wives over to act as substitutes, and their surprise when they learn that this cannot be allowed is very great.

ELECTRIC VEHICLES.

"NEW FIELD FOR THE SALE OF POWER."

In his last issued annual report, just to hand, Mr. Walter F. Long, M.I.E.E., city electrical engineer of Cape Town, alludes to the new field that has been opened up for the sale of power with the advent of the electrically-propelled commercial vehicle. The so-called electric lorry has, Mr. Long feels convinced, come to stay, and will undoubtedly be a source of large consumption in the near future.

"The convenience and economy of these vehicles for use within a prescribed area gives them," he points out, "such advantage over other means of locomotion that a large increase in their employment may be anticipated at an early date; and, in view of it being very convenient for the user to charge the accumulators late at night and during the early hours of the morning (when our load at the power station is at its minimum), the consumption of energy for these vehicles will create a very profitable form of revenue."

A special charge has been introduced for this class of consumption of 1d. per unit nett, for energy taken between the hours of 11 p.m. and 8 a.m., energy used for charging outside these hours coming under the ordinary power tariff.

The introduction in Cape Town of the combined rate of charge for domestic purposes, which provides energy for other than lighting purposes being supplied at a reduced rate has, the report goes on to state, undoubtedly increased the use of electricity in the home. "The uses of electric energy for other than lighting purposes by the householder are no doubt becoming more widely known, though perhaps not so rapidly as one would wish. The slow progress is no doubt largely due to the want of improvement in apparatus; but at the same time I feel convinced that our tariff for this class of consumption will need some reduction before any large amount of business can be obtained, in spite of the wide field there is in this country for electric cooking and heating, owing to its cleanliness and convenience."

At the present time very extensive use is made of such articles as kettles, irons, hot plates, fans and radiators; but the use of the electric stove proper has, Mr. Long regrets to say, been somewhat disappointing.

Coast Sand Dunes, Sand Spits, and Sand Wastes. (By G. O. Case. Price 5s. St. Bride's Press, Limited, 24 Bride-lane, E.C.). . . . "A most useful little book crammed with facts culled from all parts of the world and well illustrated with photographic reproductions and diagrams. Numerous references to other works are given. Mr. Case discusses the formation and distribution of sand dunes and the devastation caused by them when they move inland, and then goes on to consider protective works and the reclamation of sand wastes. If we have one criticism to offer it is that the book is too condensed. There is certainly not a superfluous paragraph."—*Geographical Journal.*

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

NORTH-EASTERN DISTRICT MEETING.

District Chairman—Mr. J. P. Wakeford, M.Inst.C.E., City Engineer, Wakefield.

A North-Eastern District meeting is to be held at Wath-upon-Dearne to-morrow (Saturday).

Programme.

10.15 a.m.—Meet at waterworks pumping station, adjoining Wath-upon-Dearne (G.C.Rly.) Station, and five minutes' walk from Wath-upon-Dearne Midland Station. Proceed to inspect the plant.

10.30 a.m.—Walk alongside the G.C. Railway to the new sewage disposal scheme in course of construction.

10.45 a.m.—Proceed to inspect the sewage disposal works.

11.30 a.m.—Proceed by motor 'buses from near Messrs. Stanley's oil works at Commonlane, along the main road *vid* Barnsley-road and Brampton to Wath Wood reservoirs to inspect works there recently carried out. *En route* inspections will be made of the public baths, mortuary, sections of Tarmac roads, and private street works.

12.45 p.m.—Leave reservoirs by motor 'bus.

1 p.m.—Lunch at the Red Lion Hotel.

2.15 p.m.—Proceed to town hall, where the institution will be welcomed by the chairman of the urban district council, Councillor Chas. Adkins, J.P.

Business:

(1) Minutes of last meeting.
(2) Correspondence.
(3) Election of executive committee.
(4) Any other business.
(5) Orphan Fund and support from N.E. District.
(6) Paper on "Notes of Municipal Works and Statistics in the Urban District of Wath-upon-Dearne," by Mr. J. H. Drew, M.Inst.C.E.I., M.R.San.I. (Member), engineer and surveyor to the urban district council, Wath-upon-Dearne, will be discussed.

5 p.m.—Tea at the Red Lion Hotel, by kind invitation of County Councillor Richard Payne, member of the Wath-upon-Dearne Urban District Council.

EASTERN SUB-DISTRICT MEETING.

District Chairman—Mr. H. T. Wakelam, M.Inst.C.E., County Engineer, Middlesex.

An Eastern Sub-District Meeting (Norfolk, Suffolk and Cambridge) will be held at Stowmarket to-morrow (Saturday).

Programme.

11.30 a.m.—Meet at the Stow Board Room (Market-place), where Mr. A. E. Ellis, J.P., chairman of the Stowmarket Urban District Council, also chairman of the Joint Sewerage Committee, will receive the members.

Read minutes of previous meeting.

Paper on "Municipal Engineering Work at Stowmarket," by Mr. Gerald W. Lingwood. (Copies of paper will be sent to members who signify intention of attending.)

1.0 p.m.—Lunch at the Fox Hotel. (Tickets, 2s. 6d. each.)

2.15 p.m.—Inspect sewage works, main sewage pumping station, waterworks, electric light works, Combs electric sewage pumping station and Combs waterworks.

4.30 p.m.—Afternoon tea at the Fox Hotel, by invitation of Mr. G. W. Lingwood.

John R. Mead,
Hon. Sub-District Secretary.

Ipswich.

WATFORD MEETING.

A meeting of the institution is to be held in the Eastern District at Watford on Saturday, October 7th.

Programme.

11.30 a.m.—Reception in the council chamber by the chairman and members of the council.

A paper by Mr. D. Waterhouse, engineer and surveyor, on "The New Water Supply and other Municipal Works at Watford," will be taken as read.

Discussion.

12.45 p.m.—Luncheon at Buck's restaurant, one minute's walk from council offices (tickets 3s. each).

2 p.m.—Walk (ten minutes) to new pumping station and softening works. These works are the completed portion of the new water scheme, which is costing about £100,000.

Members who wish to visit council's sewage pumping station, destructor and electricity works will leave the waterworks at 3.15 and walk (ten minutes) to the works.

4.30 p.m.—Assemble at "The Empress" Restaurant (one minute's walk from council offices).

where tea will be provided by the kind invitation of Mr. T. R. Clark, chairman of the council, Mr. R. A. Thorpe, vice-chairman, and Mr. S. J. Ellis, chairman of the Water Committee.

Note.—The fire station, with two motor fire engines, adjoins the council offices, and may be seen if desired.

In order that the necessary arrangements may be made, members must give notice of their intention to be present not later than Wednesday, October 4th, when a copy of the paper will be sent in due course.

P. T. Harrison, Assoc.M.Inst.C.E.,
Hon. District Secretary.

Chelmsford.

Mildred B. Robinson, B.Sc.(Lond.),
Acting-Secretary.

92 Victoria-street, Westminster, S.W.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR AND INSPECTOR OF NUISANCES.—September 30th.—Burton-on-Humber Urban District Council.—Mr. G. H. Nowell, clerk, Barton-on-Humber, Lincs.

TEMPORARY ENGINEERING ASSISTANT. — September 30th. — Corporation of Bedford. — Mr. N. Greenshields, borough engineer and surveyor, Town Hall, Bedford.

WATER INSPECTOR.—September 30th.—Corporation of Bedford. 40s. per week, with 5s. 6d. war bonus. —Mr. N. Greenshields, water engineer, Town Hall, Bedford.

SURVEYOR.—October 2nd.—Wilton Urban District Council. £140 per annum.—Mr. H. J. King, clerk, Municipal Offices.

SURVEYOR AND INSPECTOR.—October 2nd.—Llandilo Urban District Council. £80 per annum.—Mr. R. Shipley Lewis, clerk, Llandilo.

TEMPORARY INSPECTOR OF NUISANCES. — October 6th. — Chesterfield Rural District Council. £130-£140 per annum.—Mr. R. F. Hartwright, clerk, Union Offices, Chesterfield.

DISTRICT FOREMAN.—October 9th.—Corporation of Halifax. 50s. per week.—Mr. Percy Saunders, Town Hall, Halifax.

ENGINEER-IN-CHARGE.—October 14th. — Guildford Town Council. 50s. per week, with house rent and rates.—The Borough Surveyor.

ELECTRICAL ENGINEER.—October 19th.—Corporation of Wigan. £400 a year.—Mr. W. H. Tyrer, town clerk, Municipal Offices.

TEMPORARY ASSISTANT.—Corporation of Rotherham.—Mr. T. P. Collinge, borough engineer and surveyor.

TEMPORARY JUNIOR ASSISTANT. — Somerset County Council. £80 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY CLERK.—Somerset County Council. £110 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY DIVISIONAL SURVEYOR.—Somerset County Council. £115 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WIGAN.—October 2nd.—For the erection of a motor ambulance shed, for the corporation.—Mr. A. T. Gooseman, borough engineer, King-street West, Wigan.

SELBY.—October 9th.—For the erection of twenty-two cottages, for the urban district council.—Mr. B. Gray, Council Chambers, Selby.

BARKING TOWN.—October 10th.—For the repair and painting of the bascule bridge, for the urban district council.—Mr. R. A. Lay, Assoc.M.Inst.C.E., acting surveyor, Public Offices, Barking.

Engineering: Iron and Steel.

GISBORNE (New Zealand).—October 2nd.—For supplying and erecting a cooling tower for cooling the circulating water used for condensing 9,000 lb. of steam per hour, for the borough council.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

SWANAGE.—October 7th.—For sinking a shallow well, driving two short headings, and providing and running temporary pumping machinery, for the urban district council.—Mr. W. H. Pearce, Town Hall, Swanage.

MANCHESTER.—October 9th.—For the supply of a steam turbine-driven boiler-feed pump, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

ARGENTINE.—October 13th.—For the supply of 27,807 metric tons of light pipes and 32,164 metric tons of heavy pipes of cast-iron, for the Ministry of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

Mechanically-Propelled Vehicles.

BEDDINGTON AND WALLINGTON.—October 2nd. —For the supply of one 3-ton general-utility steam wagon, fitted with rubber tyres, for highway work, and one 3-ton steam wagon for the collection of refuse, for the urban district council.—Mr. S. F. R. Carter, engineer and surveyor, Wallington, Surrey.

Roads.

WESTHAMPNETT.—October 2nd.—For the supply of cartage and horse hire, for the rural district council.—Mr. J. J. Buddan, surveyor, 4 St. Pancras, Chichester.

SANDGATE.—October 2nd.—For the supply of 600 tons of Guernsey, Leicester, or Cornish granite, or Cherbourg quartzite, evenly broken to a 1½-in. gauge, and 600 tons of Guernsey, Leicester or Cornish granite, or Cherbourg quartzite chippings, evenly graded to ½-in. gauge, and free from dust, for the urban district council.—Mr. D. V. Howard, surveyor, Council Offices.

LEISTON (Suffolk).—October 4th.—For the supply of granite and coal, for the urban district council.—Mr. H. A. Mullens, clerk, Leiston.

HOVE.—October 4th.—For the supply of broken stone, for the corporation.—Borough Surveyor, Town Hall.

BERKHAMSTED.—October 7th. — For the supply of broken granite, for the urban district council. —Mr. J. R. Hadfield, surveyor, 135 High-street, Berkhamsted.

BEDLINGTON.—October 9th.—For the supply of hand-broken road whinstone, for the urban district council.—Mr. J. E. Johnson, surveyor, Bedlington.

PADDINGTON.—October 10th.—For the supply of 6,000 sq. ft. of granite setts, for the Board of Guardians.—Mr. S. J. Langford, acting clerk, 313-319 Harrow-road, W.

RAWTENSTALL.—October 14th.—For the supply of manual and team labour, for the corporation.—Borough Surveyor, Town Hall.

SHEERNESS.—October 16th.—For the supply of 100 tons of 2-in. Leicester granite, 100 tons of 1½-in. granite, 100 tons of 2-in. Kentish ragstone, and 200 yds. of clean hoggin, for the urban district council.—Mr. T. F. Berry, surveyor.

TILBURY.—October 16th.—For the construction of a section of armoured concrete road, for the urban district council.—Mr. S. A. Hill-Willis, engineer and surveyor.

DUNMOW.—October 14th.—For the hire of two steam rollers, for a minimum period of sixty working days, for the rural district council.—Mr. A. E. Floyd, clerk, Dunmow.

BEACONSFIELD.—October 25th.—For the supply of 1,000 tons of 2½-in. and 1½-in. broken granite, for the urban district council.—Mr. H. T. Smith, surveyor, Council Hall, Beaconsfield.

The Surveyor

And Municipal and County Engineer.

Vol. L. OCTOBER 6, 1916. No. 1,290.

Minutes of Proceedings.

Progress at Wath-upon-Dearne.

Those who were present at the North-Eastern District meeting of the Institution of Municipal and County Engineers at Wath-upon-Dearne on Saturday last were privileged to hear a paper of peculiar interest by Mr. J. H. Drew, the late engineer and surveyor to the council. In view of the recent extension of the waterworks and remodelling of the sewage disposal works, both of which have been designed and carried out by Mr. Drew, it was only natural that these subjects should have occupied a prominent place in the paper. But the council has also been active in many other directions. For example, the problems of highway construction which arise from modern traffic development have been met by the strengthening of foundations and the reconstruction of the surface of the principal main road with Tarmac. The first two sections of this reconstruction were carried out by direct labour in the late autumn of 1912, and eloquent testimony to the efficient way in which the work was done is afforded by the fact that not a penny has since been spent on repairs. Moreover, it is not expected that any repairs worth mentioning will be necessary for the next three or four years, although Mr. Drew wisely advocates the annual tar-spraying of the surface and careful attention to the repair of any potholes immediately upon the first signs of their appearance. Attention is now being directed to the improvement of the district roads, which are generally narrow and tortuous and without adequate foundations or drainage. Indeed, they are so unsatisfactory that a sound and comprehensive policy of systematic improvement was adopted some four years ago in pursuance of Mr. Drew's advice. Following the plan then decided upon, foundations are gradually being strengthened, adequate means of drainage are being provided, together with new surfaces either of Tarmac or granite macadam in lieu of the blast furnace slag which was formerly used.

The waterworks, of which the recent extensions are a development, were transferred to the council by an Act of 1898, which has since been supplemented by a Provisional Order extending the area of supply to an adjoining parish. For some years after the transfer the supply was satisfactory in every way, but in 1908 it began to show signs of declining efficiency. This, combined with a natural increase in population, and the provision of water-closets, public baths, and the use of water for trade purposes by a large brewery, rendered an extension of the works a matter of necessity. An agreement for a supplemental supply from the works of the Dearne Valley Water Company expired in 1903, and the council then decided to sink a borehole and erect a new pumping station. The extensions, which have been carried out by Mr. Drew, consist of a second borehole, a new and powerful pumping plant, a pumping station, 3 miles of new mains, and two reservoirs and sand filters. The pumping station and foundations for the mechanical plant were constructed at a cost of about £700 by direct labour. Reinforced concrete has been used in the construction of the roofs of the new reservoirs, and Mr. Drew not unnaturally comments upon the fact that in consequence the Local Government Board have restricted the loan period for this part of the work to ten years.

We entirely agree with his observation that the general attitude of the board in regard to loans for reinforced-concrete work is to be regretted. The matter is one to which we have called attention time after time, while engineers are practically unanimous in the opinion that this class of construction has now passed far beyond the experimental stage. It is impossible to say how long it will be before the board can be convinced of this fact, but presumably they will at length be so convinced by repeated applications for loans of longer period coupled with continued comment on their refusal. The sewerage and sewage disposal scheme was approved by the Local Government Board in March, 1914, and is now approaching completion. Provision is being made for a daily dry-weather flow of 300,000 gallons, based upon an average of 17 gallons per head for a population of 17,650. Both Mr. Drew and the authority he has served so well are to be congratulated on the way in which they have met and solved the problems of sanitary administration in this growing district as they have arisen.

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Housing and Economics.

The difficulty of providing cottages for the working classes either by private enterprise or by local authorities at economic rents, that is to say at rents which are not only within the means of the intended tenants, but which will also yield a fair return on the capital involved, has been much accentuated in recent years. This has been due primarily to a steady rise in the cost of build-

ing, and the matter has now reached a critical stage owing to the further sharp rises which have taken place since the outbreak of war. Speaking at Cardiff on Thursday of last week, Sir James Crichton-Browne claimed for every civilised man the right to a clean wigwam, and for every civilised family the right to a decent lodging, whether they can afford to pay for it or not. If this dictum be accepted it is evident that the present situation can only be met either by a general rise of wages, so as to render a larger amount available for the payment of rent by tenants, or by the provision of a considerable sum by the State to be applied as grants in aid of housing schemes. The question of which of these two devices should be resorted to is really a political one, and in the past has found the subject of acute controversy. But in view of the increasing urgency of providing housing accommodation on a large scale, and of the precedent formed by the Housing (No. 2) Act, 1914, there has recently been a considerable trend of opinion towards the method of State aid. Again, the war has emphasised the fact that the State has a greater interest in housing than has been generally realised hitherto, for not only is housing important as directly affecting the health and lives of the people, but also because of the further relationship that exists between the health and physique of the population and their ability to increase the national wealth and strength.

This latter consideration, which may be called the economic factor in housing, formed the subject of a very suggestive paper which was read at the recent annual congress of the Incorporated Sanitary Association of Scotland by Mr. W. Ross Young, the town planning engineer for the Middle Ward of Lanarkshire, and which will be reproduced in our next issue. Mr. Young pointed out that some years before the war the erection of houses for the working classes by private enterprise became economically unsound, and even those speculative builders who, towards the termination of their career, tried to meet the situation by crowding the houses into high and cheap tenements in the hope of saving land, roads, and other services, had in the end to give in, so that private enterprise, which in the past had provided 90 per cent of our working-class houses, was gradually forced from the field by sheer economic pressure, and the public, for the first time perhaps in history, were met with a new and grave situation. Local authorities at this stage, chiefly owing to the fact that they did not require profit from house building, and that they could borrow money on good terms, were still in a position to proceed with house building on an economic basis, and indeed most local authorities were moving in this direction when the war broke out. The war, however, has changed the whole economic aspect of house building by local authorities, and it is in many cases no longer possible to build houses for the working classes at such a cost as will enable them to let the house at a rental which will cover their outlays.

We cannot here discuss further the political aspect of the question, but of this we are sure, that if a serious after-war housing crisis is to be averted, municipal building on a large scale will have to be undertaken without delay. This, in its turn, involves the immediate preparation of after-war programmes. In other words, the preparation of schemes in complete detail, with plans and specifications, is *now* a matter of great urgency, so that the actual work of erection may be commenced without delay upon the declaration of peace, for, as Mr. Young said, although there may have been some excuse for our having been unprepared for war, there can be no excuse if we are not prepared for peace and the great industrial reorganisation and absorption of labour that will be necessary when it comes.

The Belfast Municipal Conference.

The Association of Municipal Authorities of Ireland held their annual conference last week at Belfast, and the proceedings afford evidence of a growing spirit of inquiry and vigilance with respect to municipal administration in that country. That much-abused phrase municipal economy received attention from the delegates, and it is possible to sympathise considerably with the view that in Ireland, as in England, a great deal too much public money is needlessly spent in Private Bill legislation at Westminster. The elaborateness and extraordinary length of many of the Local Government Board inquiries in Ireland, and the legal costs of such inquiries, also present a grievance that calls for a remedy. Municipal officials ought to be competent to deal personally with the evidence at these inquiries without, as too often happens, relying upon the aid of lawyers to whom, with curious irony, they have to give instructions. Reverting to Private Bill legislation, it is surely reprehensible that, as was mentioned by Mr. William Field, M.P., a district council which devised a scheme estimated to cost £50,000 should be forced to spend £10,000 in legal expenses in London, or that, as was the case at Queenstown, the municipal effort to obtain a pure supply of water should involve the ratepayers in costs amounting to £6,000. These things call for reform, and the association will be doing an important public service in making use of all the influence they can command to obtain reform.

The housing problem received generous consideration from the delegates, and the difficulties which it involves were not overlooked. This discussion elicited a noteworthy revelation from Dr. J. King Kerr, to the effect that, thanks to the activities of the Public Health Committee of the Belfast Corporation, there does not now exist a slum area in the city. It is significant that, while the expense and danger of the slum to the community are considerable, it at the same time represents a substantial sum financially to the owners, for Dr. Kerr stated that one of the areas acquired cost the city council about £40,000. The utilisation of water power, another of the topics discussed, ought to be well within the range of practical politics in Ireland, where the price of fuel is high and the difficulty of obtaining it great, and the conference sought to extend the basis of road improvement by calling for the application of the Development and Road Improvement Funds Act, 1909, to urban district councils as well as county and county borough councils. From the business point of view the proceedings appear to have been all that could be desired, leading to the conclusion that the association is exercising a useful and practical influence upon the municipal affairs of Ireland.

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Hydraulic Methods in Earth Dam Construction.

Excavation of earth by water jets is, under certain conditions, economical and effective. The carriage of the earth thus excavated, in suspension in water, either by gravitation or by pumping, and its deposition in such a manner as to form a bank or dam on a site selected is also to be accomplished without any very great difficulty under modern conditions. The most obvious advantage of this hydraulic method is the great saving of labour, but there are many other considerations of great practical importance to the water engineer.

The new method was attended with difficulties only to be overcome by experience, and from the failures and troubles which have occurred a perfect method is being evolved. We have such examples as the Necaxa dam in Mexico and the Gatun dam, which illustrate the case, showing clearly that the building up of a stable earth dam

by the hydraulic method is no simple matter, and, after the failures which have occurred, no little faith and courage were required in setting out to construct a dam 240 ft. high—the highest earth dam yet undertaken by the hydraulic method—at San Francisco. This, the Calaveras dam, will require more than 3,000,000 cub. yds. of earth, practically the whole of which has to be pumped. The base width of the dam is 1,300 ft.; its up-stream force is 3 to 1, and its down-stream force 2½ to 1. The hydraulic fill method was selected on account of economy, and also for the great advantage to be derived by the automatic selection of the material, which by this method is deposited in successive stages of quality ranging from extremely coarse material on the outer slopes to fine clay in the core. The material first excavated by water jets passes through a 4-in. screen, and is pumped to the outer edges of the toes of the embankment. The flow is directed towards the centre of the dam. The coarser material settles first, and the remainder is deposited in regular grade until a central pond (really the puddle trench) is reached, where the fine clay settles. The excess water overflows from this central pond or puddle trench. The total number of men employed is sixty.

When it is considered that an average of 3,600 cub. yds. of material is transported a distance of 3,000 ft. daily, the advantage of this method of excavating and placing is evident. It must not be forgotten, however, that the difficulties are not limited to excavation and placing. In the case of the Necaxa dam a very serious failure occurred owing to the slow drainage of the clay body. This retained a semi-liquid consistency, and the lateral pressure of the clay forced the outer face of the bank into the reservoir, and a very serious slip resulted. Similarly, in the case of the Gatun dam, the slopes bulged and gave considerable trouble. On the other hand, the quality of the clay core is ensured by this method as well as that of the outer slopes, and, seeing that tests are frequently made of the consistency of the clay core at the Calaveras dam, it is difficult to see how these troubles can recur if proper attention is given to the work. Seeing that the cost of the work is at present about 1s. 0½d. per cubic yard the economy is apparent, and though this cost may increase as the work nears completion, it is evident that the method possesses very great advantages. It is probable that the drainage of the excess water from the central portion will still present problems, but these should not be incapable of solution.

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Sequel to an Air Raid.

A curious sequel to one of last year's air raids was recently revealed by proceedings at the Guildhall, London, in which the trustees for the owners of certain property which was rendered dangerous on the occasion referred to were summoned at the instance of the City Corporation for the non-payment of certain surveyor's fees. The obligation to pay the fees in question was imposed on the owners by the London Building Act, and the solicitor for the defendants said that they had declined to pay as a protest against what they regarded as harsh treatment on the part of the corporation. He further advanced the proposition that the Act was intended to deal with people who, by neglect, allowed their property to get into a dilapidated and dangerous condition, but not to punish people whose difficulties arose through misfortune. With these views the presiding magistrate disagreed, and he very pertinently observed that there could be no more ground for letting off the defendants from the payment of the surveyor's fees than for relieving them from the payment of the fee of the solicitor who was appearing for them. In our opinion this remark was very much to the point. The trustees were really suffering from their own lack of foresight in not insuring the property against a risk the imminence of which they probably did not realise. There was no suggestion of inability to pay, and it would certainly have been hard on the surveyor who had done the work if he had been compelled to forego his statutory reward.

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Loans to Local Authorities.

The effect of the policy of the Local Government Board of sanctioning loans to local authorities for new expenditure only where it is proved that the expenditure cannot be avoided, postponed or reduced, is clearly shown in Part III. of the forty-fifth annual report of the department, which was issued this week. Whereas in the years 1913-15 the amount of the loans sanctioned ranged between £12,000,000 and £14,000,000, the figure for the twelve months ended March 31st was only £4,257,973, or less than one-third of the average amount sanctioned during the three previous years. The general practice has been only to sanction loans where the expenditure has been urgently needed for the furtherance of the war, and the bulk of the money has been spent on the extension of plant and cables for the manufacture and supply of electrical power to manufacturers and others engaged on the production of munitions, and on transport or other war work. Several loans have also been sanctioned for extensions of gasworks and plant which were required to meet in reased demands for gas, but in these cases, it should be noted, the carrying out of the works has resulted in a considerable increase in the production of materials used in the manufacture of high explosives. While it is not possible to state in figures the savings that have been effected by the stoppage and postponement of works by local authorities, it is of interest to mention that of loans amounting to £13,601,695, sanctioned during the year ended March 31, 1915, it has only been found necessary to re-sanction the raising of loans amounting to less than £1,500,000.

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The Stowmarket Meeting.

At a district meeting of the Institution of Municipal and County Engineers held at Stowmarket on Saturday, Mr. G. W. Lingwood, the surveyor to the urban district council, presented a paper of considerable interest, particularly with regard to the sewerage and sewage disposal of the area. The schemes which he described show clearly the advantages which may accrue from co-operation by neighbouring local authorities. It was in 1898 that the Stowmarket Council decided to join with the East Stow Rural District Council in a scheme for the disposal of the sewage of the urban part of the adjoining parishes of Stowupland and Combs. In 1913 a further scheme for dealing with the surface water and part of the old sewers was prepared by Mr. Lingwood, in consultation with Mr. Midgley Taylor, M.INST.C.E., but its execution has necessarily been deferred until the end of the war. As regards disposal, nearly the whole of the sewage arrives at the main pumping station by gravitation, a small part, however, having first to pass through a subsidiary pumping station. It is finally pumped through 3,000 ft. of rising main to the disposal works. The council are also concerned in a joint isolation hospital undertaking. In view of the frequency with which cases of separate undertakings by small local authorities are brought to our notice, it is encouraging to find a case like that of Stowmarket, in which the advantages both in efficiency and economy of joint action by neighbouring districts have been realised and utilised.

The Metric System.

By ARTHUR J. PRICE, Engineer and Surveyor to the Lytham Urban District Council.

The war has brought us into such close communication with our Allies that many of our insular ideas and customs are bound to be greatly modified, and in some cases go by the board, as the result of these intimate relations. Not only will this be the case during the war, but in many respects the change will probably be much greater when we reach the stage which has been so aptly termed "the war after the war." On all hands it is recognised that commercial competition will be much keener after the war than it was in pre-war times. The necessity for strengthening our positions by using the best available commercial weapons is admitted by everyone.

The railway, steamboat, and electric telegraph have made the world one huge market, in which the leading position we enjoyed some fifty or sixty years ago, when we were the workshop of the world, has been successfully challenged by the more enterprising and energetic of our rivals. Instead of commanding all foreign markets, we have fallen back into the second or third place. How much of this may be due to prohibitive tariffs, imposed with the express object of excluding our goods from foreign markets, while we have offered a free and open market to all comers, it is perhaps not the province of this article to discuss. We are, however, on safe ground in stating that a great change in political circles on this question has unquestionably taken place recently.

Men of mature years are naturally conservative, and often cling tenaciously to their customary methods long after they have been found to be antiquated, illogical, and inconvenient. Stubborn people can always be met who will oppose all change, however useful and beneficial the change may be. They cannot face the inconvenience of a change, however temporary, and always magnify its difficulties. The introduction of the steam engine and its application to the railway was met with violent opposition by many ignorant and interested persons. Even the arguments which were used by many shrewd business and public men now appear very crude and ridiculous. The motor car and motor wagon, which now threaten to take sole possession of our roads, could not be used until recent years without the guiding care of a flag man, and the airship and aeroplane were ridiculed as foolish and dangerous toys by a sceptical press and a short-sighted public.

No change is likely to take place in the commercial policy of this country until public opinion compels the Government to adopt it, and unfortunately the *vox populi*, to which alone politicians bow, is not as a rule very articulate on technical and scientific matters. Self-interest and the appeal of the pocket are the most potent factors in determining their views, and it is therefore necessary to convince them that a change is not only desirable but imperative if this country is to regain the proud position it held in the world's markets, and if it is not to surrender the fruits of its victory in the field in the commercial warfare which will follow the declaration of peace

AN UNSCIENTIFIC SYSTEM.

Recently we have seen a revival of the demand for the adoption of a more rational and scientific system of weights and measures than we now possess. Our system is admittedly unscientific and inconvenient, and, though its use is confined to the English-speaking race, it has so many variations that even here it is difficult to understand and clumsy to work. On the other hand we have the metric system, which, though not perfect, is based on rational and scientific principles, and is fast becoming a universal system used by all the leading countries of the world. Apart from the British Empire and America, which are certainly important exceptions, all the leading commercial nations—more than forty in all—have adopted it with slight variations. The decimal system on which the metric system is based is to some extent also adopted in America, and in Canada, Ceylon, and other of our dependencies. The dollar, which rules as the unit of exchange in these countries, is divided into 100 cents. The difficulties experienced by our commercial firms in trading with foreign countries has been the theme of most of our consuls' reports for many years past, and the leading Chambers of Commerce in this country have passed resolutions in favour of the adoption of the metric system. One of the latest bodies to support this system is the National Federation of Building Trade Employers of Great Britain, who, at their meeting at Brighton this year, passed a unanimous resolution to the effect, "That this meeting considers that the present is an opportune time to revise our system of money, weights, and measures, so as to bring them into harmony with the metrical system prevailing among the rest of the Allied nations in order to facilitate trade relations between them and us after the war." The metric system is almost solely used in all our laboratories, and the C.G.S. system is used in all the countries of the world by scientific men.

The attempt to make foreign countries accept our system of weights and measures has been responsible for a great loss of business by our traders. Before an English firm can sell or ship its goods to foreign countries it is necessary to convert our weights and measures into those of the metric system, and it has been said that while an English traveller is busy converting his measurements and prices into those of the metric system, the German steps in with his ready made and secures the order. No less than 90 per cent of those trading with us use the metric system, so that the need for us to come into line with the rest of the world should be apparent to all.

In 1868 the House of Commons passed, by 219 to 67 votes, the second reading of a Bill making it compulsory to use the metric system, but the Bill was withdrawn at the request of the Government for consideration by a Royal Commission. In 1895 a Select Committee recommended that the metrical system should be legalised for all purposes, and after a lapse of two years be rendered compulsory by Act of Parliament. This recommendation was adopted in part in 1898, as it was then made legal to use the metric system in this country, but the clause making it compulsory was unfortunately not carried. There is, however, a rumour that the Government are again seriously considering making its adoption compulsory.

SIMPLICITY OF DECIMALS.

There is no question that the metric system is easy to learn and use, is very convenient, and would save a great amount of time and labour, when compared with our own system of weights and measures. Engineers usually prefer to work in decimals, though most architects and builders show a preference for the duodecimal system. Despite the simplicity of decimals most artisans share the dislike of the late Lord Randolph Churchill for them, who, when he was Chancellor of the Exchequer, is credited with saying that he "never could understand those d d dots." The very simplicity of decimals is in many people's opinion conducive to carelessness, and they therefore stick to the cumbrous method of converting yards, feet and inches, or pounds, shillings and pence, by first multiplying and then dividing, or *vice versâ*, where a single operation of multiplication or division is all that is necessary in most calculations in the metric system. No calculation for the reduction of one class of measurement to another is required in the metric system, as the position of the decimal point is sufficient to indicate the number of each measurement. For example, we know that 2506·250 m. represents 2 kilometres, 506 metres, 250 mm., or 2506 m. 250 mm., or 2,506,250 millimetres. The simplicity and saving of time over our own system is readily seen if we consider the time and trouble required to find the number of feet and inches in, say, 1 mile, 5 furlongs, 80 yds., 2 ft., 9 in.

Every lad leaving an elementary school at fourteen should be familiar with the metric system. If this system were adopted in our schools it is said that we should be able to save a year's schooling of each lad, as quite 20 per cent of his time is now spent in trying to obtain a sufficient knowledge of arithmetic to serve for his future career. No student of municipal engineering should be able to plead ignorance of the metric system, for it enters very largely into most branches of his work. If he wishes to make an analysis of water or sewage, or even grasp the meaning of an analysis, he must know what the litre, centimetre and millimetre represent. Our army for the past two years has been continually using maps drawn to metrical scales, and the metre and kilometre are as easily used by our officers and men as the yard and mile. If the man in the street is to read his paper intelligently he

must know what the 28 cm. and the 77 mm. guns represent, and then English equivalents in inches.

VARIATION IN LOCAL STANDARDS OF MEASUREMENT.

The difficulty of understanding our English system of weights and measures is greatly increased by the variation in local standards of measurement, and in the difference in the meaning of the same terms when applied to different classes of goods. There are said to be no fewer than 200 different weights and measures by which corn is sold in this country. The English statute acre is 4,840 sq. yds., but the Irish acre is 7,840 sq. yds., the Scotch acre 6,084 sq. yds., while the Cheshire acre differs from all these with a pole of 8 yds. against the statute pole of 5½ yds. A stone of flour is 14 lb., but a stone of meat or fish is only 8 lb. A barrel of beer contains 36 gallons, but a barrel of tar or oil is usually 40 gallons. A barrel of butter weighs 224 lb., while a barrel of soap weighs 256 lb. A load of hay or a load of straw are very different in weight, and a truss of new hay is 60 lb., while a truss of old hay is only 56 lb., as the hay loses weight by sweating and becoming more seasoned. A standard of timber varies according to the Petersburg standard of 165 cub. ft. or the London standard of 270 cub. ft. Iron and steel are weighed by the avoirdupois pound of 16 oz., or 7,000 grains, while gold and silver are sold by the Troy pound of 12 oz., or 5,760 grains. The mile differs on land and sea, and the nautical mile is 6,075½ ft. against the 5,280 ft. on land. Cement is not always sold by weight, and though a bag should represent 2 cwt., an unscrupulous builder's merchant has been known to convert the 2 cwt. into 200 lb., and palm off the American ton of 2,000 lb. for the English ton of 2,240 lb. A French tonne differs again from the English and American tons, as it is 2,204 lb., or 9842 English tons. The English gallon of 277¼ cub. in. differs from the American gallon of 231 cub. in.

There are many other anomalies in our system, but enough have been quoted to prove that these weights and measures are difficult to grasp and remember, that they are cumbrous and complicated in use, and that they cause a tremendous waste of time and money. That a change from our present system to the metric system would involve some inconvenience and temporary loss is a fact that no one will attempt to deny, but it is an inconvenience which most other countries have faced, and in no case has any country accepted to revert to the old system. They all had more or less complicated system, differing one from the other, and even in different parts of the same country, but they found little difficulty in making the change. The Germans cannot be said to have ever had much love for French methods, and certainly not after 1870; but since that time they have scrapped their old chaotic system and adopted, with some slight modifications, the metric system. The great growth of Germany's foreign trade practically dates from the time that she changed her system of weights and measures and adopted a protective commercial policy.

NEED FOR A UNIVERSAL SYSTEM.

The need of a universal system is greater to-day than ever, for the whole tendency of the age is to standardise everything, from coinage to machinery. The day when every engineer and manufacturer wanted to design or make something different from everyone else has gone. The confusion and waste caused by the numberless forms of steel rails, joists, bolts and screws has led to the adoption of carefully selected types, which have been accepted as standard sizes suitable for all practical purposes, to the great convenience and economy of manufacturers and users. The great advantage which the Americans have enjoyed in the production of many kinds of machinery is not due to their better workmanship, but because they have standardised their machines, tools, and fittings. Cheapness and convenience can only be obtained by standardisation and duplication, so that the necessary tools and parts of a machine can be obtained readily in all countries, and be interchangeable throughout the civilised world. That machinery will in the near future play a much larger part in our economic life is bound to be one of the results of the war, with its dilution of labour by unskilled workmen and women. The motor car, motor wagon, and motor bus will have such an extended use that it is very necessary that standardisation of their parts should be aimed at in our own country, if we are not to be dependent on cheap foreign motor cars and heavy motor vehicles.

This standardisation makes it all the more necessary that we should adopt a system of weights and measures which is understood and used in all the countries to whom we may sell, or from whom we may buy, goods. The only system of weights and measures which approximates such an ideal standard is the metric system. It has one specific word for each unit, whether of weight, lineal, square or cubic measurement.

THE FRENCH SYSTEM.

The French system is based upon the metre, which is the measurement of length, and is equal to 39·37079 in. It was supposed to be the ten-millionth part of the distance from the Pole to the Equator, but this is not quite accurate, being a little too small, and the metre is now defined as being the length of a certain bar of iridio-platinum, preserved in the Bureau de Archives in Paris. By taking this as the basis of measurements they have produced a good working system by using decimal multiples and sub-multiples or parts. As the system was intended to be universal, Latin and Greek prefixes were chosen. For the parts the Latin for 10, 100, and 1,000 decem, centum, and mille are used, and for the multiples the Greek words deka, hecto, and kilo are used to multiply by 10, 100, and 1,000. It is not usual, however, to write all these names in full. Thus we may write 5671·246 metres, not as so many kilometres, hectometres, dekametres, metres, decimetres, centimetres, and millimetres, but as 5 kilometres, 671 metres, 246 millimetres. The system is so simple that any business man could become perfectly familiar with it in a week. If we take the land measurements which surveyors would probably use most and compare them with their English equivalents, we see at once their simplicity and the ease with which they can be used.

The are is the French unit of area, and this represents a square with sides 10 metres long, or 100 square metres; the hectare represents a square with sides of 100 metres each, or 10,000 square metres, and is equal to 2·4711 English acres. The are is divided into the square metre, a centiare, and milliare, but in practice only the hectare are and centiare are used. Compared with our land measures these are exceedingly simple and rational. The English acre with its division into 4 roods, 40 poles or perches to the rood, 30¼ yds. to the pole, 9 ft. to the yard, and 144 in. to the foot, is not only complex, but has grown up in a haphazard manner. The English land measure is to some extent decimal when the link of 7·92 in. is used, as 100 links make one chain, and 10 sq. chains are 1 rood. The areas on the Ordnance Survey plans are always computed to this scale, and the areas are given on the plans in acres and decimals to three places; but for most purposes the private surveyor usually converts the decimals into roods, poles, and yards.

All the parts of the metric system, whether of length, surface, volume, or weight, are based upon the metre, and are mutually dependent; and the multiples and sub-multiples follow the decimal arrangement. Thus the unit of volume is the litre, and this is a cube with sides of one-tenth of a metre, and is equal to 61·0234 English inches, or ·22 of an imperial gallon. The unit of weight is the gram, and is theoretically the part of the weight of a litre of water at 4 deg. Cent. Thus we have a cub. centimetre equal to one gram, and 1,000 cub. centimetres, or one litre of water, is equal to a kilogram. A cubic metre of water is equal to 1,000 litres, and weighs 1,000 kilograms, which is commonly called the metric ton = ·98 tons. The kilogram is 2·204 lb.

CURRENCY.

Attempts have been made to change the currency of this country to a decimal system, by preserving the pound as the unit, with the florin as the tenth part, the shilling equal to 50 cents, and the cent would be practically equal to a farthing. Another suggestion is to adopt the four-shilling piece as the unit, which is nearly equal to the American and Canadian dollar, and the shilling would be equal to 25 cents, with the cent nearly equal to a halfpenny. The sovereign would be equal to 10 florins or 5 double florins, or the 10 double florin, or two-pound piece, which is already coined, could be brought into more general use. There does not appear to be any great difficulty in placing our currency on a decimal basis, and the present time offers a unique opportunity of doing it. The Government and the banks between them have practically acquired all the gold in the country, and the conversion of the coinage should therefore be comparatively easy to carry out, and with the minimum amount of disturbance and inconvenience.

Reconstruction and readjustment of many trades

will be required at the close of the war, and there can be few more needed reforms than that of placing our system of weights and measures, and also our currency, on a sound and scientific basis. If this is done by adopting a practically universal system such as the metric system, we shall remove the chief handicap from which we suffer in our competition with the rest of the world.

THE DESIGN OF CONTINUOUS BEAMS.

By Ewart S. Andrews, B.Sc. (Engineering), Lond.

[Abstract of paper read before the Society of Engineers on Monday last.]

A continuous beam is one which rests on more than two supports and is classified as "a statically indeterminate structure" because the stresses in it cannot be obtained by an application of the laws of graphic statics only; a consideration of the deflected form of the beam is also necessary. The disadvantages which have been urged against continuous beams by practical engineers in the past will probably disappear as further experience is obtained in their design.

The Theorem of Three Moments gives a relation between the negative bending moments at three successive supports of a continuous beam, from which, in any given case, these bending moments can be obtained; by combining the free bending moment diagrams and the support bending moment diagrams the bending moment at any point can be found, and the reaction can be readily computed.

A numerical example of the calculations for a continuous beam of three spans is given, together with an explanation of the treatment to be adopted when one of the ends of the beam is fixed.

Tables are given of bending moment and reaction coefficients for uniformly loaded continuous beams of equal spans, varying in number from two to nine.

Winkler's diagrams for two, three and four equal spans carrying live and dead loads are given, from which the maximum positive and negative bending moments at any point of the span may be readily computed. Turneare and Maurer's coefficients for the maximum positive and negative bending moments at mid-spans and supports for equal spans from two to seven are given, together with approximate results which are sufficiently accurate in many cases for practical design.

Isolated loads on continuous beams of two equal spans are then considered and explained by the aid of a numerical example.

The paper concludes with the full calculations of the bending moments and shears for a warehouse floor framed with continuous beams. The external secondary beams carry greater loads than the internal ones, on account of the continuous construction of the floor slabs and diagrams of maximum positive and negative bending moments for loaded and unloaded conditions are given. The maximum and minimum reactions from the secondary beams form point loads upon the main beams for the loaded and unloaded conditions respectively; the resulting bending moments, combined with those due to the weight of the beam itself, are plotted upon a diagram from which the detail design of the beam can be completed.

Town Planning Institute.—At a general meeting of this body, to be held this (Friday) evening, at 92 Victoria-street, S.W., the president will deliver an address. The chair will be taken at 6.30.

Dampness in Exposed Buildings.—It would be difficult to find a building in a more exposed situation than a school which was erected some time ago on the Cotswold Hills, and the architect realised the probability of dampness if due provision were not taken. The building has been completed sufficiently long severely to test the interior, which is perfectly dry. We hear the walls were rough-casted, with Pudlo incorporated therein as a preventative against damp.

Petrol Allowances.—It was stated at the offices of the Petrol Committee on Monday that nothing can be done in regard to the increase of the allowance of petrol for commercial and certain professional purposes until the present petrol licences expire at the end of October. It is acknowledged that the situation is a little easier, but it is also pointed out that the Board of Trade have yet to consider the matter, and that the question of sending more money out of the country will have to be dealt with. An official statement is to be issued to-morrow (Saturday).

LONDON WATER SUPPLY.

AN INTERESTING ANNUAL REPORT.

Convincing evidence, if this were needed, of the importance of the work for which the Metropolitan Water Board is responsible, is to be found in the annual report of that authority, issued on Saturday last.

The board's territory extends over no less an area than 559 square miles, and water is supplied by the board to six counties: London, Essex, Hertford, Kent, Middlesex and Surrey.

Water is derived by the board from the Rivers Thames and Lea, gravel beds near the Thames, the Chadwell Spring—which is the beginning of the New River—and wells sunk in the Lea Valley on the north of the Thames, in Kent, and certain other points south of the Thames.

The board's supply (direct, and in bulk to adjacent undertakings) during the year was 89,264·2 million gallons of water, or a daily average of 243·9 million gallons. The grand total volume is equivalent to 398·5 million tons of water. The Thames furnished 57·6 per cent, the Lea 25·0 per cent, and the wells, &c., 17·4 per cent of this total.

The total estimated population directly supplied at the close of the year was 6,773,105. It is estimated that in the direct area 55·6 per cent was supplied from the Thames; 26·7 per cent from the Lea, and 17·7 per cent from the wells and springs. Of the total population 65·2 per cent is north of the Thames and 34·8 per cent south of the river. The population inside London is 67·1 per cent of the whole.

The daily average supply per head was 35·76 gallons, compared with 36·08 gallons in 1914-1915

STORAGE.

The effective amount of storage and subsidence reservoir capacity for unfiltered water possessed and in use by the board at the end of the year was as follows:—

	No.	Area in acres.	Capacity in million gallons
Thames Valley ...	31	1,026·5	7,267·5
Lea Valley ...	17	955·0	5,639·5
	48	1,981·5	12,907·0

SUSPENDED WORKS.

Acting under the Defence of the Realm Acts, the Ministry of Munitions of War, on ground of urgent national necessity, directed the cessation of work on the reservoir in course of construction at Littleton, the plant and labour being required for the production of war material. The reservoir in question will contain 7,000 million gallons, part of an authorised scheme to include a further reservoir to be constructed at Stanwell, to contain 3,300 million gallons.

The war has also interrupted the construction of the Board's new offices at Rosebery-avenue, on the site of the New River head, as also other works for the perfecting of the supply of water to the Metropolis.

This suspension includes a number of new works authorised by the Metropolitan Water Board Act, 1915, embracing the construction of reservoirs at Southgate, Eltham, Farnborough, Bromley and Shoreham; a subway or tunnel underneath Dog Kennel-hill and Grove-lane, Camberwell; well and pumping station in Eynsford; and a number of mains and pipes joining up these new reservoirs with existing reservoirs and works, and other subsidiary operations.

COMPARISON OF WORKS.

The following table shows at a glance the increases which have taken place under the board in the active equipment of the water works since the transfer of the undertakings:—

	Before June, 1904.	At March 31, 1916.
Storage reservoirs for unfiltered water	44	48
Acreage	843	1981·5
Capacity in million gallons ...	4,115·7	12907·0
Service reservoirs for filtered water	75	86
Capacity in million gallons ...	244·5	310·9
Filter beds	137	172
Acreage	139	170·7
Engines	235	280
Horse-power	32,177	43,252
Miles of water pipes	5,759	6,470

Municipal Works and Statistics of Wath-upon-Dearne.*

By J. H. DREW, M.INST.C.E.I., Late Engineer and Surveyor to the Urban District Council.

The Wath-upon-Dearne urban district comprises the townships of Wath-upon-Dearne and West Melton. In 1861 the Wath township had 382 houses and 1,690 inhabitants, while to-day there are approximately 2,683 houses and an estimated population of a little over 13,000. The district rests upon the coal measures.

Area, 2,353 acres.

Population (Census 1911), 11,880. Estimated July 1, 1916, 13,302.

Rateable value, £56,984 14s. 2d.

Assessable value, £40,374 11s. 1d.

A rate of 1d. in the £ produces £172 10s. (district rate).

The general-district rate (half-year ending September 30, 1916) is 2s. 5d. in the £.

The poor rate for Wath-upon-Dearne parish (half-year ending September 30, 1916) is 2s. 4d. in the £.

The poor rate for West Melton parish (half-year ending September 30, 1916) is 2s. 8d. in the £.

The outstanding debts for sanitary purposes on March 31, 1916, amounted to £43,576.

Compounding for general district rates is allowed upon houses up to and including £11 rateable value, and a rebate of 50 per cent is allowed to owners.

Compounding for poor rate with 30 per cent rebate is allowed up to and including houses of £8 rateable value.

Length of main road, 2 miles, 160 yds.

Length of district roads, 11 miles, 2 furlongs, 52 yds.

HIGHWAYS.

The Wombwell-lane main road passes through the district from the north-west in a south-easterly direction, its length being 2 miles, 160 yds. This road is heavily trafficked, and particularly by self-propelled vehicles of the motor and traction class. The average width of the carriageway is about 22 ft. 9 in., and in West-street at its narrowest point the width is only 14 ft. 6 in. Prior to the author's appointment no proper road foundation had ever been constructed, and the subsoil is of a sandy, loamy nature, with clay intervening. The surface was metalled with granite or whinstone water-bound macadam, but it was found, with present-day traffic and the lack of a proper foundation to the road, quite impossible to keep the road in satisfactory repair.

With the aid of grants from the Road Board, the county council have been enabled to sanction the reconstruction of the surface with Tarmac, and the provision of adequate or strengthened foundations in several sections of the main road, and the work has been carried out by the author by direct labour. An area of 26,380 super. yds. have been surfaced with a 3-in. coat of Tarmac with very satisfactory results, and for durability, economy in construction, maintenance and noiselessness, Tarmac is specially adapted for country and residential or district roads similar in character to those with which the author has had to deal. A tarred limestone road in a district so damp and liable to fogs as Wath-upon-Dearne would not be a success, especially as the air is often charged with the waste gases and sulphur from the coke ovens and other works in the district. The author has observed a road in another district in which he was surveyor made of tarred limestone very badly eaten away as a result of the acid fumes from a carbonising plant being deposited in damp, muggy weather upon the road.

The first two sections of main road reconstructed were laid in September and November, 1912, on the road leading from Wath-upon-Dearne to Barnsley, and much subjected to motor traffic and a constant motor-omnibus service. Since its reconstruction not a penny has been spent on this road in repairs. Each year the surface has been tar-sprayed, at a cost of about 1½d. per super. yard, including gritting with clean ½-in. whinstone chippings.

Particulars of the cost of this work of reconstruction are as follows:—

* From a paper presented at a North-Eastern District meeting of the Institution of Municipal and County Engineers held at Wath-upon-Dearne on Saturday last.

SECTION No. 1. (Area 3,370 super. yards.)

Strengthening foundations, drainage, scarifying and preparation other than surfacing—

	£	s.	d.
Labour ...	132	0	0
Materials ...	116	12	0
Haulage ...	62	15	0
Rolling ...	33	10	0
	£344	17	0

or, say, 2s. 0½d. per sq. yd.

Surfacing with 3-in. Tarmac—

	£	s.	d.
Labour ...	26	5	0
Materials ...	267	15	0
Haulage ...	43	0	0
Rolling ...	14	1	3
	£351	1	3

or, say, 2s. 1d. per sq. yd.

Making a total cost of 4s. 1½d. per super. yard, including foundation work.

SECTION No. 2. (Area 3,157 super. yards.)

Strengthening foundations, drainage, scarifying and preparation other than surfacing—

	£	s.	d.
Labour ...	125	0	0
Materials ...	157	2	2
Haulage ...	82	16	0
Rolling ...	30	15	2
	£395	13	4

or, say, 2s. 6d. per sup. yd.

Surfacing with 3-in. Tarmac—

	£	s.	d.
Labour ...	22	10	0
Materials ...	249	18	0
Haulage ...	42	0	0
Rolling ...	13	3	0
	£327	11	0

or, say, 2s. 0½d. per sup. yd.

Total cost ... 4s. 6½d.

Comparative prices of materials—

	1912.	1916.
Lump slag for foundations	3s. 5d. per ton.	3s. 10d. per ton.
3-in. slag rejections for road formation ...	4s. per ton.	4s. 11d. per ton.
Tarmac, ¾-in., 1½-in and 2½-in. ...	12s. 9d. per ton.	13s. 6d. per ton.
Comparative prices of labour—		
Foremen ...	6s. 8d. per day.	6s. 11d. per day.
Labourers	4s. and 4s. 2d. per day.	4s. 9d. and 4s. 11d. per day.
Paviors and masons ...	9d. per hour.	10d. per hour.
Hire of horse, cart and man	8s. per day.	9s. per day.
Hire of horse, cart and man	5s. 4d. on Sat.	6s. on Saturday.
Road roller	25s. per day.	25s. per day.

When these two sections of road were being constructed the cost of unloading and carting material from the station to the roads was about 2s. per ton.

The old water-bound macadam road cost about 1s. 8d. per super. yard to metal, and had a life of three to four years.

The foundation, constructed of slag, is about 9 in. deep, and the Tarmac 3 in. in thickness, a ton of slag covering about 4 super. yds. in the foundations, and a ton of Tarmac covers an area of approximately 8 super. yds.

A census of traffic over these sections of road was taken on six days between June 26 and July 2, 1914, and based upon the Road Board's assumed weight of vehicles, &c.; it was found that a tonnage of 5,666 tons had passed over the road, and no fewer than 6,623 vehicles and horses. Taking the width of carriageway at the average of 22 ft. 9 in., this is equal to an average weight of 41·5 tons per foot width passing over the carriageway daily.

The entire cost of the repairs and maintenance of the main road is paid by the West Riding of Yorkshire County Council, plus a charge of 5 per cent for establishment charges and use of tools, and special grants are made by the county council from time to time towards improvements of the main road.

Average cost per year: Maintenance, repairs and reconstruction, £1,619 10s. 3d.; improvements, £376 4s. 5½d. Total, £1,995 14s. 8½d.

Average cost per mile: Maintenance, repairs and reconstruction, £774 11s.; improvements, £179 18s. 7d. Total £954 9s. 7d.

It is confidently anticipated that now the whole of the main road has been surfaced with Tarmac (except about 2,000 super. yds. where the gradients are too steep to permit the use of tarred material), the expenditure on repairs during the next three or four years will be practically *nil*, although the author advocates the annual tar-spraying of the surface and careful attention to the repair of any potholes immediately signs of their appearance are forthcoming.

Compared with pre-war road construction in 1914, the author estimates the cost of road construction in this district has increased by about 12½ per cent—viz., materials, 11 per cent; manual labour, 14 per cent; and team labour, 12½ per cent. These figures are based upon a considerable number of accepted tenders.

DISTRICT ROADS.

The length of district roads repairable by the council is 11·28 miles. Most of these roads are of a rural character, and have been constructed without adequate foundations for present-day traffic, and in the past, prior to the author's appointment, they were usually only metalled with a thin coating of water-bound slag macadam. The roads are narrow and tortuous, and the average width, inclusive of footpaths, is only between 29 ft. and 30 ft., with carriageways about 21 ft. wide. Surface-water drains are provided in many of the roads, but these are often very shallow and broken in by the traffic, or otherwise choked. A considerable amount of money will need to be spent in properly draining many of the district roads in the near future. The result of inefficient drainage can be observed in many of the streets after rainfall, and the channels and road surfaces are very badly scoured away at these times by the volume of water which collects.

It will be understood that such roads are very much below the standard required to carry modern traffic and to meet the public demand for good roads. The council, acting upon the author's advice, have during the past four years adopted a sound policy for the gradual improvement of the district roads by the provision of adequate means of drainage, strengthening or putting in foundations and surfacing with a 3-in. coat of Tarmac where the gradient will allow, and the use of granite macadam in lieu of blast-furnace slag, where it is undesirable to adopt tarred material for surfacing. Tar-spraying has been very successful in this district during the past four years, and is much appreciated by the residents, and it certainly lengthens the life of the roads by 25 to 30 per cent, even if heavily trafficked. The cost of the work for the last two seasons has been as follows:—

	1916.	1915.	
Providing tar, hire of machine and tar-spraying	·938d.	·875d.	per sq. yd.
Whinstone chippings at 9s. 9d. per ton to cover about 300 sq. yds. per ton	·388d.	·398d.	,, ,,
Manual labour, gritting and sweeping only	·111d.	·113d.	,, ,,
Team labour, carting materials, &c.	·085d.	·107d.	,, ,,
	1·522d.	1·493d.	,, ,,
Five per cent establishment charges and use of tools	·076d.	·075d.	,, ,,
Totals	1·598d.	1·568d.	,, ,,
Area of roadway treated	57,155	42,127	sq. yds.

The cost of tar-spraying in 1913 was 1·85d., and in 1914 1·8d. per super. yard, inclusive of all charges. The above figures relate to both district roads and the main road.

The tar used is refined tar to Road Board specification for No. 1 tar, and costs 35s. per ton at Wath-upon-Dearne Station.

For water-bound macadam roads the area covered is about 6 yds. per gallon, and for Tarmac roads 1 gallon of tar is used to an area of 10 to 12 super. yds.; but the condition of the road at the time of tar-spraying must influence this very important factor.

There are very few flagged footpaths, and most of the paths are made up of limestone tar-macadam, which is mixed at the depot. This form of footpath is not economical, except in very lightly used streets and where coals have not to be tipped on the footpaths prior to being got into the cellars and coal places. Where the paths are narrow, and there is considerable pedestrian traffic, it is certainly more economical and efficient to flag the footpaths.

Despite considerable extraordinary expenditure, and the adoption of higher grade materials, the increased cost of labour, &c., the roads have been maintained and repaired during the author's tenure of office at an average cost of £189 8s. 5d. per mile, as against a cost of £204 13s. 2d. per mile during the previous three years.

PRIVATE STREET WORKS.

On taking up his duties at Wath-upon-Dearne the author was surprised to learn that 36-ft. streets had been satisfactorily constructed at the cost to frontagers or speculative builders of 14s. to 15s. per lineal yard of frontage, or, say 30s. per lineal yard of street. This figure was reputed to cover the cost of 9-in. and 6-in. surface-water drainage, street gullies, excavation, levelling, 6-in. ballast foundation, 3 in. of slag macadam coating to carriageways, 12-in. by 6-in. kerbing, channelling, and 2½-in. tarred limestone macadam footpaths.

On being asked to prepare specifications, estimates, plans, &c., for the making up of a private street, the author was quite unable to devise a scheme to cost less than 29s. 6d. per lineal yard frontage, or about £3 per yard-run of street, as follows:—

Sewers.—Surface-water drain of 9 in. and 6 in., best quality stoneware pipes, laid at an average depth of 4 ft. Manhole, 4 ft. 6 in. by 2 ft. 6 in. (inside measurement). Connections to fall pipes to be made with 4-in. stoneware pipes. Joints to be made with gaskin and cement mortar.

Gullies.—Naylor's rectangular stoneware gullies, 21 in. by 16 in. by 24 in. deep, with 6-in. outlet. Connected to surface-water sewer by 6-in. stoneware pipes. Gullies to be surrounded with 6 in. of 6 to 1 Portland cement concrete for a depth of 18 in., and pipes leading from gully outlet for a distance of 4 ft. also to be surrounded with concrete. Each gully to be provided with cast-iron grate and frame to the pattern used by the council and weighing 1½ cwts.

Foundation of Carriageway.—To be formed of hand-pitched hard quality lump slag, local stone, crozzle bricks, or other suitable hardcore. Surface of pitching to be covered with broken stone or slag macadam 3-in. gauge. Foundation to be rolled with 10-ton roller until thoroughly consolidated to a thickness not less than 8 in. in every part, and with a cross-fall from centre of road to channel of ½ in. to a foot.

Levelling. Existing ground to be excavated or filled in as required to an average depth of 11 in. below intended finished surface level of carriageway, as shown upon sections. Footpath to be levelled to admit of 1-in. ash foundation and a 2½-in. thickness of tar-macadam being placed in position and with a cross-fall of ½ in. to the foot towards the kerb and channel.

Metalling of Carriageway.—When the whole of the ballasting completed to surveyor's satisfaction, the surface to be coated with a covering of 3 in. deep of 2½-in. best quality hard slag macadam, free from honeycomb. The macadam to be bound with ¼-in. slag chippings, and only a very limited quantity of road scrapings to be allowed for binding. A 10-ton roller to be used to consolidate the macadam, and when completed the road to have an even surface, devoid of depressions and with a uniform cross-fall from centre of road to channel of ½ in. to 1 ft. The total depth of foundation and macadam surface coating not to be less than 11 in. in any part when completed.

Footways.—To be formed of 9-in. bed of clean engine ashes thoroughly consolidated with hand roller to form foundation. Limestone or slag tar-paving, 2½ in. in thickness, to be laid and consolidated, laid in two layers. The bottom layer of 1½-in. material consolidated to a thickness of 2 in., the top layer of ¾-in. gauge consolidated to ½ in. thickness, making a total thickness of 2½-in. tar-paving, each layer to be separately consolidated with hand roller 8 to 12 cwt. in weight, the surface of the top layer to be dressed with white Derbyshire spar or limestone chippings and rolled.

Channelling.—The channel to be formed of 12-in. wide by 6-in. deep hard York stone channel stones, laid on a bed of 1-in. clean engine ashes, and the joints racked with chippings and run with pitch. Stone to be from Brighouse or other approved quarries.

Kerbing.—The kerbing to be formed of 12-in. wide by 6-in. deep hard York stone kerbs from Brighouse or other approved quarries, and to be sound, hard stone, free from beds, laminations or other defects, and to be dressed and squared on exposed faces. Kerb to be laid upon a bed of 1-in. clean engine ashes, and to be true to line and gradient. Each kerb to be solidly laid upon its bed and driven up close to next joint. The joints to be flushed with lime mortar and neatly pointed.

This specification was considered far too stringent, and the author was asked to prepare a scheme for a satisfactory street at a figure not to exceed £2 5s. per lineal yard of street. The author reported that he was unable to do this.

It was eventually decided to give the owners three months in which to have the street made up, on the understanding that if the work was satisfactorily executed the council would afterwards take over the street.

The street was satisfactorily completed and taken over by the council. Despite all the criticism, the author was not astonished to learn that the actual cost to the owners had been 30s. 7½d. per lineal yard of frontage, or about 1s. 1d. per lineal yard in excess of the author's estimate which was looked upon and described as most excessive.

BATHS.

The council own a very good public plunge bath and slipper baths, which were designed and erected under the supervision of Mr. H. C. Poole. The amount of the loan sanctioned by the Local Government Board was £2,350 for the erection of the baths and appurtenant buildings, and £120 for the land, making a total cost of £2,470. At this figure members will admit that the baths were most economically constructed, and on inspection it will be seen they do credit to a working-class district of the character of Wath-upon-Dearne.

There is an annual deficit after meeting capital and revenue charges equal on the average to about a 2d. rate. The charges for admission are very moderate. The baths are open daily from April 1st to September 30th, and in normal times the bath is open during winter months on Fridays and Saturdays, but owing to the war it was kept closed altogether last winter, except for slipper baths.

Briefly the details of construction are as follows. Brick buildings with doubled pressed facing bricks and York stone dressings, plunge bath, shower and soap baths, six slipper baths, ticket office, storerooms, boiler-house, wash-house, drying stove, and caretaker's quarters. The size of the plunge bath is 75 ft. long by 30 ft. 6in. wide and 6 ft. 4in. deep at one end and 3 ft. at the shallow end. The tank is constructed of cement concrete with steel wire and angle bar reinforcement, and the pond is set on a 6-in. bed of well puddled clay to act as a cushion and prevent as far as possible any fractures being caused by uneven settlement, and the concrete walls and floor are faced with white glazed bricks. The tank is surrounded by a gangway, in which are placed all steam and water pipes, valves, &c., for free inspection. The outlet is provided with a fixed grate in the floor connected by a 12-in. pipe to the Brook Dyke. The dressing-boxes are of the collapsible type, and can be removed to allow for seating accommodation when galas or sports are being held. There is a gallery at one end of the building only. The water is heated by two of Senger's patent injectors fixed on the inlet supply and provided with steam from a 14-ft. by 5-ft. Cornish boiler, and the water is allowed to circulate through the bath until the desired temperature is obtained.

FIRE BRIGADE.

The council own a motor fire engine . . purchased in November, 1910, at a cost of £750, and the Local Government Board granted a ten years' loan.

The brigade consists of a captain, vice-captain, four drivers and nine firemen. A retaining fee is paid to each member of the brigade, and a small fee is paid for attendance at drills and at fires.

The annual cost of maintenance, insurance, fees, &c., amount to about £105 per annum, plus the repayment of principal and interest on the fire engine of about £91, or, say, a cost to the district of £200 per year until the loan is cleared off.

There is at present no electric bell system for calling the brigade, but the members all reside within easy call of the fire station and can be called together very promptly in case of an alarm being given.

A fee is charged for use of the engine and brigade outside the council's area.

HORSES AND STEAM WAGON.

The council own seven horses, together with the usual carts, cesspool carts, and municipal implements and appliances, and also a Garrett's No. 5 heavy type steam wagon having steel tyres. Team labour has to be hired in addition as necessity demands. The steam wagon weighs 5 tons unloaded, and it has a capacity of 4½ cub. yds., or about 5 tons when loaded with macadam.

Probably members will be interested to know the cost of "horse keep," and the table below gives comparative costs in 1913 and 1916. The price of seeds, straw, oats and bran are somewhat high in this district:—

	1913. £ s. d.		1916. £ s. d.
Seeds and straw . .	151 15 10	...	173 14 10
Bran and oats ...	118 0 8	...	128 13 10
Saddler	3 14 9		7 8 7
Blacksmith... . .	17 18 10	...	19 16 3
Veterinary surgeon ...	7 0 0	...	7 0 0
Rent and rates for pasture land	36 0 0	...	40 12 8
Miscellaneous . .	13 0 1	...	8 19 3
Totals	£347 10 2	. .	386 5 5
Cost per horse per week, say	19/2		21/3

The steam wagon was purchased in 1912 at a cost of £525, and the Local Government Board granted a loan for its purchase repayable in seven years. The standing annual capital charges amount to £83.

Even if the steam wagon were kept constantly employed the weekly cost of running would amount to £6 8s. 9d., or £1 3s. 4d. per day (5½ working days per week). In this district there is not sufficient work to keep the steam wagon in employment much more than half the year, and the journeys for haulage of road material are very short, the maximum distance being 1½ miles. Under these circumstances members will understand that the steam wagon under such conditions is not an economical investment. The author understands that when purchasing the wagon the council intended that it should be used for the removal of nightsoil from back yards and streets to the tips, but it has not been found practicable to apply it to this purpose owing to its weight, the nature of its construction, the impossibility of access to, and turning in confined spaces such as back yards, and the damage which would follow to private property where the streets and yards are not constructed for this class of traffic.

Day carters are paid at the rate of £1 10s. 6d. per week and the night carters £1 12s. 6d. per week, so that at the present rate for maintenance of horses, even without making any allowance for depreciation of stock, it will be noticed that there is no saving over hired team labour, beyond the convenience of having the men and carts at hand when required. The hire of a horse, man and cart for a full week is only £2 11s.

REFUSE REMOVAL AND SCAVENGING.

This work is carried out by the council's own staff, and something like 6,206 loads of refuse are removed annually, at a cost of £992 13s. 7d., or approximately 3s. 2d. per load. Carting distances to the tips in this district are long journeys, and the cost given includes labour, carting, disinfectants, rent of tips, tools, and all expenses. Much shop refuse is removed from premises, and no special charge is made for this, as in some districts.

STREET LIGHTING.

The district is well lighted by Sugg's incandescent "Windsor" lamps, of which there are 281 in the district. Owing to restricted lighting during the past two years it is not possible to give figures as to cost with accuracy for purposes of comparison. The normal price paid for gas for street lighting is 2s. 9½d. per 1,000 cub. ft. The lighting hours in a season are about 3,000.

Approximately 100 lamps have the burners adjusted to consume 4 ft. per hour, and the remainder burn 5 ft. per hour. The lamplighters are paid at the rate of 3½d. per lamp per week, and each man has a district of about fifty-five to sixty lamps to attend to. The lamplighters clean lanterns, report breakages, and light and extinguish the lamps, but new mantles and repairs are done by the council's plumber.

TOWN PLANNING AND HOUSING.

In 1912, prior to the author's appointment, the council sent representatives to a local town planning conference convened by the Bolton-upon-Dearne Urban District Council. On September 12, 1912, it was resolved that the council withdraw from the Bolton and District Town Planning Committee. Since that day town planning has been a dead letter in the discussions of the council.

Some steps have been taken towards a housing scheme, and preliminary arrangements were made for the purchase of land for a scheme for, roughly, 250 houses, and designs for laying out the ground and for various types of cottages were presented to the council by Mr. Tennant, architect, Pontefract, who had been selected to carry out the architectural duties.

Apathy, vested interests, and finally the outbreak of war put a stop to the housing aspirations of the Housing Sub-Committee.

This question of housing and town planning should at no distant date be made compulsory throughout the rapidly growing South Yorkshire coalfield; if not, the speculative and jerry builder will reign supreme, and golden opportunities for the development and building of villages and towns on town planning and hygienic lines will have passed, never more to return.

LIGHT RAILWAY SCHEME.

In 1913 the Wath Council opposed successfully in Parliament the Mexborough and Swinton Tramways

(Railless Traction) Bill, and gave an undertaking to promote a municipal scheme in a later session.

As a result, in the November Session, 1913, a scheme for light railways, promoted jointly by the Wath-upon-Dearne, Wombwell, Bolton-on-Dearne and Thurnscoe Urban District Councils, was presented to the Light Railway Commissioners. The engineer for this scheme is Mr. Stephen Sellon, M.INST.C.E., Westminster. There are twenty-three different railways in this scheme, and a mileage of about 18 miles. The railways will run between the districts of Thurnscoe, Bolton-on-Dearne, Wath-upon-Dearne, West Melton, Brampton Bierlow, Wombwell, Ardsley and Stairfoot, Worsborough, Barnsley, Adwick-upon-Dearne and Swinton. It is a comprehensive scheme for linking up the districts named. The estimated cost, as prepared by Mr. Sellon in November, 1913, was £151,891 5s., including generating station, which will be reduced by £20,000 in the event of the proposed electric lighting scheme maturing.

Very great opposition has been offered to the scheme, particularly by the railway and colliery companies, but, nevertheless, the greater portion of it has been sanctioned, although the war will put a stop to any constructional work for some time to come. The costs incurred in promotion expenses to date are approximately £10,728. The railways not sanctioned are from Wath-upon-Dearne to Bolton-on-Dearne, and 1 mile 6 furlongs in length. In November, 1915, a further application was presented to the Light Railway Commissioners to sanction these railways and to abandon sections which had already been sanctioned between Bolton-on-Dearne and Adwick-upon-Dearne. This application has not yet been heard, but for the scheme to be a success the author considers that it is imperative to gain the sanction of the light railways between Wath-upon-Dearne and Bolton-on-Dearne, *viâ* Station-road.

The gross receipts are estimated to be about £35,000 for passengers and £500 for advertisements, carriage of parcels, &c., making £35,500 in all. It is estimated that after the working expenses are met and the interest and sinking fund, there will be a balance for reserve of £4,750. The car mileage is calculated at 844,147 per annum, and the average amount to be taken per car-mile, 10d.; the amount per route-mile, £1,954 per annum; receipts per head of population served, 8s. 7d.; and the average population served per route-mile, 4,550, with an average service of about 10 minutes, and 7½ minutes on certain routes at special periods.

DEARNE VALLEY ELECTRIC LIGHTING.

An Electric Lighting Order has been obtained by the joint councils of Wath-upon-Dearne, Bolton-on-Dearne, and Thurnscoe. Mr. Stephen Sellon, M.INST.C.E., is also engineer for this scheme, and his estimate of cost presented to the councils in November, 1914, was £45,925. Like the light railways scheme, owing to the war this will be held in abeyance for some considerable time to come. The cost of obtaining this Order was £1,163 15s. 11d., and the proportion of these costs payable by the Wath Council is £385 6s. 6d. The estimate of total receipts for energy is £7,500 per annum, with an expenditure, including interest and sinking fund, of £6,896, leaving a nett surplus of £604.

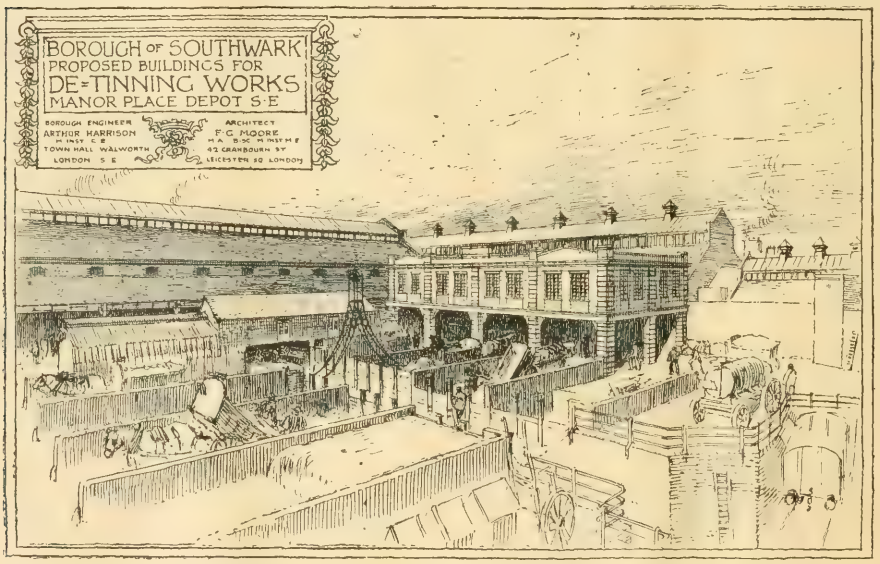
GASWORKS.

The gasworks are owned jointly by the urban district councils of Wath-upon-Dearne and Bolton-on-Dearne. The Thurnscoe Urban District Council will shortly be admitted as a constituent authority of the gas board, and an Act of Parliament has recently been obtained to sanction the inclusion of this council.

The purchase price of the undertaking was £66,611 14s. 1d.; the amount of capital expenditure since the acquisition of the concern has been £24,800, making a total capital cost to date of £91,411 14s. 1d., and the sum of £10,125 has been paid off, while an additional sum of £1,975 12s. 11d. stands to the credit of the sinking fund account.

BRITISH DE-TINNING COMPANY'S SOUTHWARK WORKS.

We reproduce below a perspective view of the buildings which are about to be erected by the British De-Tinning Company at the Manor-place depot of the Southwark Borough Council. Southwark, whose enterprise in matters connected with refuse disposal is well known, has taken up with enthusiasm the scheme of the De-Tinning Company, by which local authorities can obtain an increased revenue from the utilisation of their waste metals, and the works shown in the sketch will be one of the first results of the agreement which has been drawn up between them and the company.



A full list of the public bodies to be represented at the forthcoming meeting in London, at which the scheme referred to will be outlined, will be found in our issue of September 22nd.

Proposed Municipal 'Bus Service for Caerphilly.—The South Wales Transport Company, who now run a motor-'bus service in the Aber Valley, having refused to make any contribution towards the upkeep of the roads, the Caerphilly Urban District Council have decided to seek Parliamentary powers for the purpose of providing a service between Caerphilly and Senghenydd.

SANITARY INSPECTORS' ASSOCIATION.

ANNUAL CONFERENCE AT CARDIFF.

The thirtieth annual conference of the Sanitary Inspectors' Association was held on Thursday in last week at Cardiff, when the discussion of papers opened. The members, numbering about 150, were welcomed at the City Hall by the Lord Mayor (Dr. R. J. Smith). His lordship, in the course of his remarks, said that by the aid of Nature and municipal activity Cardiff had been made a city comparable for beauty with almost any other in the United Kingdom. In science, in education, and in health they could claim to be in the front rank. They spent about £28,000 in their health department each year, and forty officers were employed to deal with the health problems of the city. He offered the delegates, who were soldiers in a great cause, a hearty welcome to the city.

THE PRESIDENTIAL ADDRESS.

Sir James Crichton-Browne, in the course of his presidential address, described Cardiff as "wisely sanitary and public spirited" in its administration, and proceeded to say that the war was a deplorable catastrophe that had indefinitely postponed many reforms of hygiene. In the great military camps at home sanitation had successfully stood the severest tests. He emphasised the importance of sanitary vigilance during the post-war period, quoting historical examples of the awful havoc created by disease during similar periods. Nerve troubles had been a notable effect of the war, not merely as the result of trench-strain, but as the result of high-pressure strain of work among those at home. The question of housing reform would be one of the most important matters to be dealt with after the war. They must recognise the right of every civilised man to a clean wigwam, and of every civilised family to a decent lodging, whether they could afford to pay for it or not. A slum was not merely a menace to itself, but to its neighbourhood. His conviction was that the two effectual remedies for slumdom were (1) a living wage, (2) extensive building operations under the direction and, if need be, with the assistance of the State. He emphasised the enormous importance of bath-room accommodation, which was not, he thought, at present adequately recognised. Congested areas in our towns must be demolished, and 300,000 good, habitable cottages were wanted in the country immediately. Dilatory tactics and mere makeshifts would no longer be tolerated. Compulsory powers must be conferred on the Local Government Board to enable them to bring pressure to bear on reluctant authorities. Sir James urged the necessity of paying more attention to afforestation. In conclusion, he said the war was not only a deadly, but a dirty, business. It had been essential to the rise of civilisation, but it was no integral part of it.

On the motion of Mr. Towy Thomas, seconded by Mr. W. G. Kershaw (Hampshire), hearty thanks were accorded to the president for his address.

"The Municipal Progress of Cardiff" was dealt with in a paper by the city engineer, Mr. W. Harpur, who received a vote of thanks, on the motion of Mr. E. A. Davies (Keighley), seconded by Mr. H. H. Spears (West Bromwich).

WHAT SANITATION HAS ACCOMPLISHED.

At the Friday session Mr. J. Towy Thomas, Rhondda, chairman of the general council, read a paper on "The Accomplishments of Sanitation." He quoted figures showing how ravages of small-pox, cholera, and other destructive pestilences decreased in violence as the laws of hygiene and public sanitation became more recognised and practised. Millions of money had been spent in this and other allied directions, while notable strides forward had been made in regard to housing. Sanitary science cared not merely for the welfare of the individuals of one generation, but also and perhaps still more so—for the countless generations yet to be born.

Mr. Mark Harcombe, in moving a vote of thanks to Mr. Thomas, said the work of sanitary inspectors deserved greater support than it had from local authorities.

Mr. J. P. Humphery, Reigate, seconded the proposition.

THE HOUSING QUESTION.

Bailie J. Stewart, Glasgow, in the course of a paper on "Health and Housing," said he believed everyone was nearly satisfied that private enterprise in the building of small cottages had broken down, and local authorities were frightened at the magnitude of the problem. "I think," said Bailie Stewart, "we ought to have a Minister of Health, whose duty it would be to consider this question in all its bearings, and to deal with it in such a way as would promote the best interests of the nation." Bailie Stewart quoted some striking facts showing how bad housing was at the root of some of the most glaring of Glasgow's evils, such as infantile mortality and tuberculosis. Sanatoria had been erected and patients treated therein at great expense, but if the results in the other parts of the kingdom were akin to what they were in Glasgow it would have to be admitted that it had all been something like a gigantic failure. He suggested that the Government should make grants of about £30,000,000 per annum for some years to local authorities to enable them to erect houses, charging such a rent as would pay the cost of maintenance, and repay by sinking fund the capital cost in sixty years.

Mr. W. Harpur, city engineer of Cardiff, said he would not like it to go forth that the appalling picture of the housing conditions in Glasgow, more particularly with regard to two and three roomed tenements, was in any way applicable to Cardiff or the neighbouring district. He did not know of a single one-room tenement in Cardiff. There might be a few two-roomed tenements, and three-roomed tenements were exceedingly scarce, and probably confined to the oldest houses in the town. The typical house in Cardiff was a six-roomed cottage. It was true that in many, and perhaps too many, cases two families resided in a six-roomed cottage, but with a garden at the rear he believed this was better from a health point of view than a three-roomed house.

Mr. J. Storey (Nantwich), said that in regard to the provision of hygienic cottages the rural districts were doing better work than cities and large towns. As men were being taken for the Army he believed wealth should be commandeered to meet housing necessities.

Mr. E. A. Davies (Keighley) suggested a higher general living wage as among some of the means that might bring about better housing conditions. At the same time this would not, of necessity, mean a clean dwelling. Dirt was found not only in the slums. He had known a house of £40 a year with several inches of dirt on the dining room floor.

Mr. D. R. Thomas (Gowerton) emphasised the importance of the teaching of hygiene in the schools.

The President said that as a patriotic Scotsman he must take some notice as to the reflections cast upon Glasgow, a city that had to contend with tremendous difficulties. No city in the world had made a more splendid contribution to sanitary science. He was not so sure that the birth-rate was declining. Moreover, when the public came to realise the evil consequences of some of the expedients resorted to, there would, no doubt, come some check.

HYGIENE IN WAR-TIME.

Mr. Charles Hockley, chief sanitary inspector of Barry, in a paper on "Hygiene in War Time," urged that if we were to survive strongly and vigorously as a first-class European Power, we must apply ourselves unremittingly to our social and public health problems.

The delegates were conveyed in motors to the western sewerage station and outfall, and in the evening were entertained at tea and a concert at the Seamen's Institute by Mrs. Jenkins, wife of Mr. David Jenkins, chief port sanitary inspector, hon. local secretary to the conference.

SANITARY INSPECTION AND PUBLIC HEALTH.

On Saturday, the concluding day of the conference, discussion took place on a paper (read on the previous day) by Mr. T. G. Dee (Westminster), entitled "Public Health: The Sanitary Inspector's Part Therein."

Mr. E. A. Dawes (Keighley) said it was not yet understood in this country what importance attached to sanitary inspection work being well done. If the work were properly understood the inspector's statutory position would be no longer in danger, and facilities would be given for his better training, and a chair might be provided in one of the newer universities. Only one university in the country had established a degree for hygiene, whilst the sanitary inspector—the practical exponent of applied sanitary science—was shut out from competition in that examination. He suggested that their association might be employed by the Government to take an oversight of the food supplies of the camps and garrisons; and in respect to housing he expressed the view that the Government

might withdraw the embargo placed upon the local authorities in the execution of work under the Housing Act.

Mr. Kershaw (Hampstead) insisted that public health administration should be a national affair. Until tackled on national lines the sanitary inspector would not get the opportunity he deserved. The keynote of that conference was housing. One of the greatest curses of housing reforms was that when councils carried out schemes they did not rehouse the people whom they had displaced.

Mr. Speake (Shrewsbury) said their work would be easier if public health law were simplified. There was going to be a "big push" in sanitary work after the war, and they should prepare for that "war" by getting ready in time.

Mr. Brocklehurst (Horwich, Lancs) did not agree with the suggestion of a Minister of Health. They had had one already in the person of Mr. John Burns. He would like to see such statutory powers in operation as would compel the slum property landlord to live in the worst slum house he owned.

In the course of the proceedings a presentation was made to Mr. Arthur Kent, the secretary of the Defence League, and warm thanks were voted to Mr. Towy Thomas for his services as chairman during the year.

A CHEAP FUEL.

UTILISATION OF HOUSE REFUSE.

At the National Economy Exhibition, recently held at the People's Palace Mile End-road, E., Mr. Reginald Brown, M.INST.C.E., M.I.M.E., &c., the engineer to the Southall-Norwood Urban District Council, had an educational exhibit in which he showed the various steps in the manufacture of fuel from house refuse by a process of which he is the inventor. The interest taken by the visitors was a clear proof of the keenness of housewives in the important quest for a "cheap fire."

Mr. Brown, by a simple process of crushing, pressing and impregnating, is able to produce an excellent fuel from what has hitherto been waste material, which in many districts disfigures the landscape and causes a considerable nuisance. Mr. Brown's process is "utilisation," not "destruction," and is extremely simple, carried on without any possibility of a nuisance arising, and economical.

The cost of the necessary plant, and also the production of finished fuel per ton, will, of course, depend upon the output desired. Speaking generally, the cost per ton would not, we understand, exceed 7s. 6d. (including all charges) and, from the heating value of the fuel alone could be sold at a cost which would not only cover cost of production, but also a considerable profit, while, in addition, the cost of present methods would be saved.

Mr. Brown claims that local authorities, by the adoption of the process, will secure, among other things, the following advantages:—

(1) Disposal works can be central, and so save cartage.

(2) Refuse converted as received, and can be stored without any nuisance arising, for any length of time, and used as and when required.

(3) The receipts from sale of the fuel will more than cover the costs of conversion.

(4) Costs of present methods entirely obviated.

(5) The request "Burn your refuse and so save your rates" is brought home more forcibly than ever.

(6) Local authorities may by this means set a real example of "National economy."

Roadmen's Wages.—At the last meeting of Norfolk County Council the estimated expenditure of the Western Highways Committee for the ensuing quarter, amounting to just over £6,000, was ordered to be transferred to the highways accountant. Mr. George Edwards asked whether the committee had taken into consideration a possible increase in wages to the roadmen. He thought that if there was not soon a decrease in the cost of living the men would of dire necessity be compelled to ask for an increase in wages. Mr. S. Oldman replied that there was always a margin in the estimates, and there would also be a surplus owing to the impossibility of obtaining delivery of material. If the dire necessity arose of increasing the men's wages, he hoped they would be prepared to meet it.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Will not the application recently made by an Earl's daughter for employment as a road labourer in a Sheffield rural district cause somewhat of a "flutter" in the minds of surveyors, if they think that some day they may have to arrange for ladies of title to sweep up leaves and litter, or remove road slop, in their district? But when we come to think of it, is there anything *infra dig.* in labour? Is not idleness really more ignominious and vulgar than honest work?

. . . . .

Was it not rather a novel and startling request of a lady at Claygate, Surrey, the other day, when she asked the Esher Council to cut down a plane tree in front of her house because the proximity of such trees was conducive to cancer? Is it surprising that the council declined to remove the tree under such a pretext; and what will the medical profession think of such an allegation?

. . . . .

Has the borough of Tenby succeeded in obtaining an assistant borough surveyor at the munificent salary of 30s. a week?

. . . . .

Why is it that there are still to be found people who decry the proposal to save the waste products of our dustbins, when we read that the profits of the Preston Waste Paper Committee for one year were more than £300, and that the Grimsby scavengers acknowledge that the rags which they pick out of the refuse, and regard as their rightful perquisite, are worth 4s. a week per man to them? Is it not almost inconceivable that we should permit this waste of valuable material to continue because of the trouble it would be to organise a proper system for saving it?

. . . . .

Is it not rather interesting to note that Dr. Angus Macdonald, in the *Journal of State Medicine* for September, states emphatically that salt is an excellent deodorant? Are there not many of us who can remember the serious opposition that was offered some years ago to the proposal to use sea water for sewer flushing purposes on the ground that it would hasten decomposition, cause evil smells, and damage the sewers? Is it not curious to note that sometimes what is wrong to-day is right to-morrow, and *vice versâ*?

. . . . .

Have we not now had sufficient experience of our altered time to pronounce it an unqualified success? Should we not all be exceedingly grateful to the late Mr. Willett for so persistently urging the merits of his suggestion in face of strenuous opposition from wiseacres who did not understand the question, and may we not all hope that this daylight saving will be enforced, not only during the war, but for all time in the future?

. . . . .

Was not Mr. Gerald Stoney's address to the Engineering Section of the British Association for the Advancement of Science upon "Engineering Problems of To-day" full of facts as to our failures in the past and suggestions for the future if our great engineering industrial establishments are to hold their own against those of other nations? Is it not quite true that our Government, and also manufacturers, have looked with almost disfavour upon science as compared with what is called practical knowledge, and that had it not been for private munificence our technical institutes and universities would not exist?

. . . . .

Would not a great saving in the erection of all brick buildings be effected if the trade would supply ½ bricks, ¼ bricks, and ¾ bricks, instead of only bricks of one size? Would not this save a large amount of labour in brick cutting with a trowel and waste of thousands of bricks which have cost money in material, labour, fuel, and cartage? Why is it that we are so wedded to precedent? Or is it that the trades unions would object to this obvious saving of labour?

. . . . .

Is it not rather prophetic of the enormous amount of work which will be required on our roads after the war is over when we read that a Warwickshire firm of road repairers have no fewer than twenty-five steam rollers standing idle owing to the lack of drivers? Should not all manufacturers of road material and others engaged in road work be on the alert *now* for the good time that is coming, and still keep the existence of their firms prominently before their coming clients?

Institution of Municipal and County Engineers.

NORTH-EASTERN DISTRICT MEETING AT WATH-UPON-DEARNE.

A North-Eastern District meeting of the Institution of Municipal and County Engineers was held at Wath-upon-Dearne on Saturday last, the district chairman (Mr. J. P. Wakeford, city engineer of Wakefield) presiding. Prior to assembling at the town hall, the members were afforded an opportunity of inspecting the new sewage disposal works, reservoirs, and other works, described in a former which Mr. J. H. Drew, for the past four years engineer and surveyor to the urban district council, is now borough surveyor of Grantham, afterwards presented for discussion. The attendance list was signed by the following, viz.:—Messrs. M. Saby (Leeds), G. A. Hart (Leeds), W. Fowlds (Keighley), W. Quest (Wombwell), W. T. Lancashire (Leeds), W. H. Russell (Leeds), F. Massie (Wakefield), J. A. Green (Sheffield), J. E. Aldersley (Barnsley), W. J. Steele (Newcastle-on-Tyne), W. Ellis (Barnoldswick), J. D. Milner (Uganda), F. J. Thackray (Hoyland), E. J. Silcock (Westminster and Leeds), C. E. Rivers (Harrogate), R. E. Ford (Doncaster), T. H. Hardstone (Alloa), W. T. T. Hasseldine (Wath), Leslie Roseveare (South Shields), W. J. Hadfield (Sheffield), Frank Hewitt (Kiveton Park), G. Gledhill (Adwick-le-Street, Doncaster), H. Holmes (Ossett), J. H. Drew (Wath), A. Lupton (Leeds), W. T. Lyman (Cudworth), A. Thompson (Wath), M. Robson (Wath), T. Winfield (Wath), P. C. Muspratt (Wath), F. J. Allott (Wath), F. Baker (Wath), F. J. Burman (Wath), W. Wilby (Gildersome, near Leeds), R. Payne (Wath), C. Adkins (Wath), and W. Riley (Wath).

The chairman of the district council, Councillor Charles Adkins, J.P., in welcoming the visitors said he was pleased to see such a large number present. He hoped that what they had seen that morning had not only been of an enjoyable character, but that eventually it would also prove of educational value. That was not a large district, but they were proud of some of their public works. There was an old saying that no one was too old to learn, and he did not suppose that engineers and surveyors were an exception to that rule—there was always some little wrinkle that they could pick up if they kept their eyes open. They had made some little headway since Mr. Drew came to Wath, and they would see from that gentleman's paper an account of the various works he had been engaged upon. Previous to Mr. Drew coming to Wath they had a plentiful supply of water at the borehole, but, unfortunately, they had not the means of conveying it to the people, and Mr. Drew quickly told them where the evil was and suggested a remedy. The council took his advice, and instructed him to prepare plans for enlarging the pumping plant and for increasing the mains and reservoirs which they had seen that morning. Their sewage disposal works, through subsidence and other causes, were much out of date, and the Rivers Board had been pressing a long time for an improved effluent. Mr. Drew took the matter in hand, and they had that morning seen how the works were progressing. But for the terrible war the scheme would now have been completed. He hoped the sewage works would prove as great a success as was the waterworks undertaking. The council were desirous that the effluent should be as pure as it was practicable to make it, and they were confident that the works, when constructed, would achieve the object in view. Many of their contemplated street widenings and improvements had been postponed owing to the war. Although Mr. Drew was that day finishing his official commission at Wath as surveyor, he was glad to say that they were retaining his services as engineer for the sewage outfall works until their completion. After Mr. Drew had gone the sewage works would remain as a monument to that gentleman's good work during the time he was in Wath.

Mr. WAKEFORD, in returning thanks, remarked that Wath, a colliery district, certainly had a great deal of interest for municipal engineers whose energies and abilities were directed to grappling with improvements in modern industrial development. The district included many members who served much smaller authorities than Wath, and in almost every instance the engineer and surveyor was expected to do everything required in the way of engineering design and construction and to possess a knowledge of all the men and materials which came within the scope of the municipal authority. It was, therefore, very necessary that the members of the institution should visit different districts from time to time, in order to see the methods of handling men and materials in those particular districts. They seemed to have spent a great deal of money in Wath on their sewerage, sewage disposal and water works. These were, perhaps, the most important of the subjects which came within the duties of a municipal engineer, and he was sure Mr. Drew was to be congratulated on his successful work in these directions, for the work in each department redounded to his credit. The other things they had been shown were also of very great interest, and the members of the institution thanked the Wath Urban Council for the facilities they had given them for the inspection that day and for the use of the town hall.

WATH-UPON-DEARNE MUNICIPAL WORKS.

It was agreed that Mr. Drew's paper, which is reproduced elsewhere in this issue, should be taken as read.

In proposing a vote of thanks to Mr. Drew, the CHAIRMAN said that what struck a good many of the members and especially those who were connected with larger towns than Wath—was that in a district like this, where the surveyor's staff was so very small such a large amount of work should have been undertaken. Mr. Drew was certainly to be congratulated upon the way the various schemes had been carried out. He held that it was always better to inspect undertakings like sewage works while they were in course of construction rather when they had been completed, because in the former case they had better opportunities afforded for carrying away with them useful hints which might be of use in their own districts. It would be interesting to see the class of effluent that would be turned out here eventually, and he had no doubt an opportunity of doing so would be afforded those who expressed that desire. He noticed in reference to the figures upon which Mr. Drew had designed this scheme that no allowance had been made for any differential treatment of the sewage by reason of the presence or admission to the sewers of trade effluents. It might be that the volume of the trade effluent was not sufficient to warrant a special application being made to the Local Government Board. In 1910, in designing the new scheme at Wakefield, they made representations to the Local Government Board as to the treatment of six volumes, and suggested five. Practically one-half of their 2,250,000 gallons was trade waste. The Local Government Board gave conditional consent to the treatment as proposed. Certain other towns had secured even greater advantages from the Local Government Board than had Wakefield. At Keighley, for instance, they treated much less than six volumes, while Leeds treated something like four and a-quarter volumes. The speaker went on to say that Mr. Drew's statistics regarding the strengthening of road foundations were of great value as confirming the element of economy that might be obtained. He was in entire agreement with Mr. Drew as to the superiority of tar-macadam, which gave an excellent surface with good wear. He was at variance with Mr. Drew on the subject of limestone roadways. At Wakefield, in all their private streets which were not subject to heavy traffic, tar-macadam was part of the standard specification, and if it was properly prepared—which was the crux of the whole question—it proved uniformly satisfactory. He was strongly in favour of tar-spraying, on the ground that it prolonged the life of the road, and particularly of limestone roads. There was not the slightest doubt that tar protected roads against the action of gas fumes. With regard to private street work, he was convinced that really substantial work gave the greatest satisfaction to all parties in the end. It was unfair to saddle ratepayers with the maintenance of streets of unsatisfactory construction.

Mr. F. MASSIE (Wakefield) seconded, and in the course of his remarks expressed strong disapproval of giving so high a rebate as 50 per cent to owners of property up to and including £11 per annum rateable value. The worst feature about this system was that it had a tendency to make the amount of the rate in the £ considerably higher than it would be if this system were abolished. Low bases of assess-

ment were equally objectionable. He agreed that if macadam roads were tar-sprayed it would go a long way towards getting over the difficulty caused by acid fumes in the atmosphere. The round of inspection that morning had been very instructive to all present. It would not be for want of care and thought in designing if the sewage disposal works did not prove the success they all hoped would be the case. Sewage works had an unhappy way of not always fulfilling the hopes of their designers. The greatest difficulty they had to contend with was that sewage varied so very much in its composition. They all wished Mr. Drew every success in his new appointment.

Mr. E. J. Silcock (Westminster and Leeds) said the new sewage works had been excellently designed, and the members had had an opportunity of seeing them in a very interesting stage. They would all be further pleased to see the results produced. The town of Wath was very much to be congratulated upon having such facilities for obtaining water within its own boundaries. It was rather a hard water, and no doubt the question of softening was one that would have to be considered in the near future. He regarded the new engine that had been put down as a very fine piece of work—one that would give a very high degree of efficiency and great saving of fuel as compared with the old plant. The engine was so well constructed that it would still be doing its work when they had ceased to practise civil engineering! As the sewage was almost all domestic, the problem was easier than in some other towns of the West Riding. At the same time it was a strong sewage, and there might be some little trouble with regard to smell unless the preliminary adding of chemicals was properly carried out. He understood that Mr. Drew proposed to use precipitants, and they would probably reduce the odour to some extent. He was much impressed by the admirable arrangements that had been made for removing the sludge from the various tanks, as this was about the main point in dealing with sewage, as it made all the difference whether the works would be economically run or not. Generally, he thought the works would be efficient, and certainly they reflected great credit upon Mr. Drew, their engineer.

Mr. W. J. Hadfield (Sheffield) said he supposed he had had as much experience as anybody of tar-macadam, and the more he saw of it the more he was convinced that it was the right thing for roads having to carry a moderate amount of motor-bus traffic. He gave details regarding certain busy roads in Sheffield in support of this view. In Sheffield they were now commencing to put down roads of clinker and bitumen, which they regarded as a step in advance of tar-macadam. It would certainly do for those places where wood would be too expensive. He was willing to use limestone for the bottom coat when they could not get slag cheaper, but not for the top coat. They used slag with nearly all their tar-macadam at Sheffield. He had tried granite, but three times out of four they got wrong with it.

Mr. L. Roseveare (South Shields) said that engineers and surveyors could learn a lot by visiting some of the smaller places. He found that engineers in the smaller places were up against bigger problems than their *confrères* in the larger towns, and he considered that Mr. Drew had done wonderful things on a rateable value such as Wath had. He noticed that their water had 30 degrees of hardness. He was sorry for Wath-upon-Dearne if they had to put it in kitchen boilers. It would mean frequent cleaning out of the boilers and the use of much more soap, while the meters would only last two years.

Mr. F. Hewitt (Kiveton Park) said his experience was that limestone made a very fine dust of the consistency of flour, and in the autumn weather was apt to get very greasy. He was astonished at the tremendous amount of work Mr. Drew had got through in four years, for he had not only tried, but had succeeded, in "gingering up" this district.

Mr. Hepworth (West Riding County Council) said that his authority practically limited the use of limestone for the roads to limestone areas. Where there was heavy motor traffic, they found that limestone had no recuperative properties. Motor traffic quickly ruined the surface beyond recovery, and the county council would hesitate before using limestone if tarred slag was to be had at a reasonable price.

The resolution was carried unanimously.

Mr. Drew briefly replied to the points raised, and said it had been a great pleasure to him to have the meeting at Wath, particularly seeing that it was his last official day there. The meeting was arranged in May—long before it was known that he was likely to leave. He would be pleased to show any individual member over the works, or give further information at any future time. As to trade sewage, they had about 10 per cent of brewery waste. As to the use of limestone, his paper referred to district roads, and not to private street works. Where they had not heavy traffic, tarred limestone might be used, but he would not use it on busy roads. He quite agreed with Mr. Massie that 50 per cent rebate on rates was very high. There it practically meant a rebate of £1,800 a year, which had to be made up by people who did not get the benefit of a rebate, and that made the rates appear high. The question of softening the water had been considered by the council, and would no doubt be taken in hand before many years were gone. At present there were heavy loans to pay off. The estimate for softening was something like 2½d. per 1,000 gallons.

Before separating the members were entertained to tea at the Red Lion Hotel by County Councillor Richard Payne, a member of the Wath-upon-Dearne Urban District Council.

EASTERN SUB-DISTRICT MEETING AT STOWMARKET.

A very successful meeting of the Eastern Sub-District (Norfolk, Suffolk and Cambridge) of the Institution of Municipal and County Engineers was held on Saturday last at Stowmarket, by the invitation of Mr. Gerald W. Lingwood, A.R.SAN.I., &c., engineer and surveyor to the urban district council and Joint Sewerage Committee.

The weather was all that could be desired, and an exceptionally good attendance of members gathered together, including Mr. Walter Noble (vice-chairman, Stowmarket Urban District Council), Mr. Wm. G. Balls, J.P., Mr. Arthur E. Collins (past-president), Messrs. G. W. Lingwood (Stowmarket), A. Ainsworth Hunt (Bury St. Edmunds), Gordon Harrison (East Stow Rural District Council), A. Daniel Ennals (Thedwastre Rural District Council), Robert E. Wilson (Leiston), Leonard Leeper (Great Yarmouth), Henry Miller (East Suffolk County Council), Harold Collins (Colchester), Felix Collins (Ipswich), Thomas Jones (Ipswich), G. W. Spurring (Harwich), James A. Webbe (Hendon), Edward Willis (Chiswick), Julian Julian (Cambridge), J. Rowland Hill (Ipswich), and John R. Mead (Ipswich), the hon. sub-district secretary.

Mr. Walter Noble (vice-chairman of the Stowmarket Urban District Council) apologised for the absence of the chairman (Mr. A. E. Ellis), who had been unexpectedly called away on work of national importance, and extended to the members a hearty welcome to the town. Their profession, he said, played a very important part in the local government of this country, and had given valuable assistance to the military authorities in various parts since the present war commenced. At Stowmarket, Mr. Noble said, they were fortunate in having a very able engineer and surveyor, and he hoped the members would spend a pleasant day in discussing and visiting the various works under the charge of Mr. Lingwood.

Mr. Arthur E. Collins (Norwich), on behalf of those present, returned thanks for so hearty a welcome, and stated that the members were very pleased to have the opportunity of visiting Stowmarket and discussing the various problems mentioned in the paper before them.

In the unavoidable absence of the district chairman (Mr. H. T. Wakelam), Mr. Arthur E. Collins (past-president) occupied the chair.

The minutes of the last meeting (Sheringham) were read and confirmed, and the hon. sub-district secretary stated he had received letters of apology from ten members who were unable to attend. He also requested members to fill in and return the forms in connection with "Road Tarring, 1916," and reported that he had been able to arrange for the following sub-district meetings during 1917:—

Beccles, April 7th—Mr. C. L. Hamby.
Ely, June 2nd—Mr. R. S. W. Perkins.
King's Lynn, July 28th—Mr. A. J. Smith.
Leiston, September 29th—Mr. Robert E. Wilson.

The hon. sub-district secretary stated that he desired to offer his best thanks to the various gentlemen mentioned above for kindly inviting the members to visit their towns on the dates mentioned.

The Surveyor
And Municipal and County Engineer.

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MUNICIPAL ENGINEERING WORK AT STOWMARKET.

A paper on this subject, extracts from which appear elsewhere in this issue, was submitted by Mr. G. W. Lingwood. In asking the members to take the contribution as read, he supplemented it with a few remarks drawing the members' attention to a few interesting and important points, such as the payment received from the county council for maintenance of main roads, the work on the sewage farm, and the reconstruction of sewers, and stated that at the present time the labourers were receiving about 6s. per week more than they were in 1914. Mr. Lingwood thanked Mr. Henry Miller, Mr. Gordon Harrison and Mr. Napier Prentice for their assistance and information in connection with several matters mentioned in the paper before the meeting.

Mr. John R. Mead (Ipswich) stated that there was a general feeling of dissatisfaction among surveyors to borough and urban district councils in East Suffolk as to the contribution received from the county council towards the cost of maintenance of main roads passing through their districts, and although he had no doubt there was an amount to be said for both sides, it did appear from the figures Mr. Lingwood had given in his paper that the amount received in the case of Stowmarket was considerably below the average amount contributed in similar cases by other county councils throughout the country. Mr. Mead stated he had received a letter from Mr. F. Hall Smith (Sheringham) giving particulars of what amounts he understood were allowed by the Norfolk County Council, which are as follows: (1) Total cost of maintenance of main roads and footpaths in connection with same, 12½ per cent establishment charges; (3) £10 per mile for watering non-tarred roads, nothing for watering tarred roads; (4) two-thirds the cost of scavenging, skirting-up, &c.; (5) half the cost of improvements—*i.e.*, widenings; (6) three-quarters the cost of tar-painting.

The Chairman (Mr. Arthur E. Collins) suggested that as this was an important matter it should be discussed first and the remainder of the paper later.

Mr. Harold Collins (Colchester) stated that in connection with the Colchester main roads the Essex County Council paid—(1) Total cost of repairs; (2) 60 per cent of cost of improvements; (3) total cost of tar-painting; (4) total cost of watering.

Mr. Edward Willis (Chiswick) stated that the Middlesex County Council allowed the following payments in connection with main roads—(1) Total cost of maintenance; (2) half the cost of improvements; (3) half to three-quarters the cost of footpaths; (4) the scavenging was somewhat difficult to agree upon, as in some cases it was suggested the roads opposite shops were scavenged somewhat frequently.

Mr. Julian Julian (Cambridge) suggested that the experience of Cambridge could not be compared with other urban districts in the county, as theirs was the only one in the county. Up to about 1909-10 Cambridge had an agreement with the county council, who paid a lump sum of about £2,000 per annum. It was found that the expenditure on main roads was much more than this—in one year it amounted to £3,800. Unfortunately, the two councils were not able to come to an agreement, and the matter was referred to arbitration, the Local Government Board's award being for a payment by the county council of £3,554 per annum. Details of how this amount is made up were not given, but it might be assumed as follows: (1) Total cost of maintenance of roads and paths; (2) total cost of tarring; (3) Quarter of the total cost of scavenging and watering.

Mr. Henry Miller (East Suffolk County Council) stated that he thought it would be interesting to the members if he gave a little of the history of Suffolk roads. It was really rather a long story, but he would be as brief as possible. When the turnpike roads were "disturnpiked" they would have become main roads through urban districts, but the magistrates refused to make the roads main roads through such districts. The cost of maintenance was first met by the county council allowing the towns an amount per mile equal to the average cost per mile throughout the county, and for some time this arrangement was satisfactory to both parties. About 1910, for various reasons, the allowance was increased, and about this time he (Mr. Miller) ceased to be responsible for the roads, but retained the bridges and buildings. Mr. Miller stated that he understood the present position was that the county council were prepared to look upon the roads which they had been contributing towards as main roads providing they were satisfactorily repaired and provided, where necessary, with kerbs, channels and footpaths.

Mr. Arthur E. Collins (chairman) inquired why the various towns did not appeal to the Local Government Board, and Mr. Miller stated, in reply, that he thought they did not do so because they considered the original arrangement was a satisfactory one.

Mr. James A. Webb (Hendon) inquired whether the amounts stated in the paper included maintenance of footpaths, and was informed by the author that the figures included repairs to footpaths.

Mr. Robert E. Wilson (Leiston) stated that Leiston was one of the districts in East Suffolk, and that the position there was somewhat similar to Stowmarket in regard to grants. There were about 3 miles of main road, and £277 per annum was allowed by the county council.

A good discussion on the remainder of the paper followed, those taking part being the chairman, Mr. Arthur E. Collins, Messrs. Henry Miller, Edward Willis, Leonard Leeper and Harold Collins.

Mr. Lingwood was heartily thanked for his paper, and the members then proceeded to the waterworks to inspect the plant, after which they had lunch at the Fox Hotel.

In the afternoon the main sewage pumping station, sewage farm, Combs electric sewage pumping station, Combs waterworks and the electricity works were visited.

At the invitation of Mr. Lingwood, the members returned to the Fox Hotel, where afternoon tea was provided.

Mr. Arthur E. Collins, on behalf of all present, thanked Mr. Lingwood for all his trouble, kindness and hospitality, and also thanked Mr. Gordon Harrison (East Stow Rural District Council) for his assistance when members visited the works at Combs. This concluded a very enjoyable meeting.

CANDY FILTERS AT STOWMARKET.

In connection with the visit to the Stowmarket waterworks, it is of interest to mention that some three years ago, in consequence of the hardness and rusty appearance of the water supplied to the town, it was decided to instal the Candy combined softening and oxidising filtration process. In this process the water, which is pumped from two boreholes, has, while on its way to the plant, cream of lime injected into it by a small pump, the water and lime then flowing into the bottom of a large closed cylinder. In half an hour the water reaches the top, losing, in the course of its journey upwards, the greater portion of the iron, and its hardness, which falls as sludge. It is now partially treated, and flows into a battery of Candy filters. The water enters at the top of the filters, and, after being sprayed through compressed

air, passes first through the patent pre-filters, constructed in the upper portion of the filters, which retain a large proportion of the suspended matter, consisting of chalk and iron, and finally through the fine filtering bed, constructed in the lower portion of the filter.

The very best results have, we understand, resulted from the installation of the Candy plant, the water being all that can be desired in appearance, purity and softness.

MANCHESTER DRAINAGE.

THE ACTIVATED SLUDGE PROCESS.

The annual report of the Manchester Rivers Committee, presented to the city council on Wednesday, states that the total volume of sewage dealt with by the various filter-beds (primary contact and storm-water filters) during the year amounted to 14,731,401,000 gallons, or 94·1 per cent of the total flow of sewage. Despite a seriously depleted laboratory staff, considerable progress has been made during the year with the development of the activated sludge process of sewage purification, which was originated at Davyhulme.

Owing to the existing Treasury regulations, it has not been possible to proceed during the year with extensions involving capital expenditure. This failure to construct purification works to deal with the increased volumes of sewage received at Davyhulme during the past two years, together with the inability to continue the usual routine renewal operations, which are essential for the maintenance of the capacity of the existing purification plant, has given rise to considerable anxiety in regard to the general treatment of the sewage. In view of the difficulties of the situation it is satisfactory to find that the percentage purification effected during the year has not suffered in comparison with that of the previous year.

It cannot be expected, the report adds, that such results will be maintained under the existing abnormal conditions, and with a continuance of the present labour shortage an obligatory reduction of the load on the filtration areas at Davyhulme may be anticipated in the near future. Critical as the situation is, it is not without recompense, inasmuch as the present interregnum in capital expenditure is allowing time for the development of the activated sludge process of sewage purification. It is hoped that the establishment of this process as a practical and economic means of sewage purification will enable a considerable saving to be effected in the cost of the necessary future extensions at Davyhulme.

Northampton Polytechnic Institute, Clerkenwell.—The classes for the day courses at this institute commenced on Monday last; those for the evening courses started last week. The programme of work for the new session has necessarily been given very careful consideration by the governing body, and, speaking generally, it has been decided to continue to announce the various regular classes which have been announced in previous sessions. While the courses in the engineering day college are to be continued, the second and third year courses, which ordinarily extend from September to Easter, are to commence in January and to be continued until July. This will enable the students to work up to Christmas in the munitions workshop. Full details of the syllabus and the equipment are to be found in the institute "Announcements."

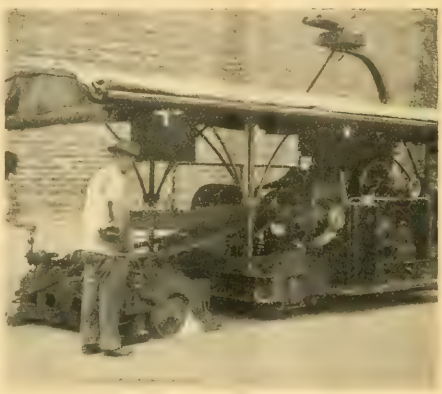
What a Captain Owed to his "Swan" Pen.—"Herewith I am sending you my 'Swan' fountain pen, or rather what remains of it," writes a captain who took part in a recent advance. "It seems to me that it may interest you to see the state it is in, and to know how it happened. On the 15th inst. I was in a certain wood—about the farthest point in the British advance—which was being heavily shelled. A shell burst very close indeed, and a piece from it broke through a lamp on my belt, turned into my left breast-pocket, hit my watch and my whistle, and then went through and hit the pen, which was in its steel case inside my tunic, and finally gave me a small cut on my stomach. The piece I found in my pocket afterwards. There was more ink than blood, as it happened, but the bump rather startled me. Undoubtedly the lamp and the pen saved me from any serious injury." Our readers should send for a free booklet about the "Swan" to the manufacturers—Mabie, Todd & Co., Limited, 79 and 90 High Holborn, London, W.C.

REMODELLING OF TRAMWAY RAILS.

DEMONSTRATION AT BEXLEY.

The Woods Gilbert Rail Planer Company have recently entered into a contract with the Bexley Heath Urban District Council Tramways for dressing joints and removing corrugations from the rails, and at the recent conference of the Municipal Tramways Association the manager, Mr. Stokes, invited the members of that body to inspect the work in progress in his town. At this demonstration a good representation of tramway managers and engineers from all parts of the country was obtained. Again on Wednesday last Mr. Stokes invited members of the Metropolitan Tramway Managers' Association to attend a further demonstration, during which the efficiency of the machine was generally commented upon.

The work undertaken by the Woods Gilbert process consists in its entirety of deepening grooves and reducing high checks by means of a movable milling



The Woods Gilbert Rail Planer.

machine and of grinding out corrugations and levelling hammered joints by means of a grinding attachment. The total weight of the machines used is from 10 to 15 tons.

The work in progress at Bexley Heath consists entirely of grinding, and a milling head is not, therefore, at the moment attached to the machine employed in the operations.

The work is usually undertaken during the night time, when the cars are not running, but in this case the demonstration was held by daylight to meet the convenience of those attending.

It is expected that within the next two or three weeks the work at Bexley will be completed, after which the machine is to be moved to Bolton, to commence on a very extensive contract in that town. This will afford a good opportunity for tramway engineers in and around the Lancashire district to make an inspection of this most interesting machine.

The company's first contract in this country was on the Oldham, Ashton and Hyde Tramways, where the life of the rail has been increased by something like six years, and, although the work has been completed for nearly four years, there are as yet no signs of corrugations recurring.

Work has also been undertaken at Thanet, Cardiff and Wigan, and has proved so successful in the last-mentioned place that two further contracts have been entered into for additional work on the tracks.

Municipal Economy.—In a paper on this subject, submitted at the fifth annual conference of the Association of Municipal Authorities of Ireland, Mr. R. Finlay Heron, M.A., deprecated what he called "absurd cheeseparing and mischievous suggestions for economy," such as reducing the number of scavengers on the roads or allowing public buildings to fall into dilapidation to save painting. He submitted that economies might be effected by the unification or reduction in the number of local authorities, amalgamation of adjoining districts, and reduction in the number of representatives. He also suggested the abolition of Private Bill legislation.

Institution of Municipal Engineers.

MEETING AT GLOUCESTER.

A meeting of the Western and South Wales Districts of the Institution of Municipal Engineers was held at Gloucester on the 28th ult., Mr. Henry J. Weaver, M.Inst.C.E., M.I.Mech.E., F.G.S., occupying the chair. Apologies for non-attendance from Messrs. H. Hulse, borough surveyor and engineer of Droitwich, and W. Whitehouse, surveyor and water engineer to the East Dean Rural District Council, were read, and there was also a letter from Mr. Henry C. Adams, M.Inst.C.E., president of the institution, explanatory of the fact that pressure of work in connection with munitions prevented his attendance.

ELECTION OF DISTRICT CHAIRMAN.

The first business on the agenda was the election of a district chairman in place of Mr. Hulse, whose term of office had expired.

Mr. John Brook (Stratford-on-Avon) urged upon the meeting the necessity for an energetic man, one who would interest himself in the district, and, above all, one who would have freedom to attend to his duties. He had pleasure in proposing Mr. Henry J. Weaver.

Mr. A. W. Shorland (surveyor and water engineer, Tewkesbury Rural District Council), in seconding, said that, with full knowledge of Mr. Weaver, he had no hesitation in saying that a better man for the position could not be obtained. Mr. Weaver would, he was confident, wake things up and would put more life into the district.

Mr. Weaver said that, although his life was bound up with municipal engineering, he did not now occupy an official position. He was one of the oldest members of the institution, however, and attended the first meeting, which was held in 1908. The offer of the chair of the district was a gratifying one to him, and he would be pleased to accept it. He would do his very best, although he would rather that Mr. Hulse should have had an opportunity of reconsidering the matter. Mr. Hulse had, however, had a long term of office, and his (Mr. Hulse's) decision not to seek renomination rendered his acceptance of the office quite in order.

THE DISTRICT SECRETARYSHIP.

Mr. Weaver said that the next matter on the agenda was the appointment of honorary district secretary, and he felt it would be a mistake to make a change. In Mr. Brook they had an excellent man, and he hoped that he would stand for at least one more year.

Mr. John Brook (Stratford-on-Avon) expressed the hope that he might have been relieved of office. At his age one was not so fit as one would wish, and he would have been glad to see a younger and more energetic member occupy the post. He would suggest Mr. Machin as a coadjutor, and if this was assented to by the meeting he would be pleased to accept joint office.

Mr. Cyril B. Machin (sanitary surveyor, Alcester Rural District Council), having given his consent to the joint appointment, the elections were formally made.

SUPERANNUATION.

Mr. A. W. Shorland (Tewkesbury), speaking on the question of meetings for the ensuing year, proposed that their minimum number should be three, inclusive of the annual meeting to be held in July. The matter of superannuation was not sufficiently to the fore, and it was time that municipal engineers commenced making themselves a nuisance to the Government; only by some such means would they attain their object. Resolutions were well in their way, but they were not all-sufficing. Action should follow. He moved: "That this meeting of the Western and South Wales Districts consider the question of superannuation all-important, and hope that the institution will make it a main plank of their platform." He moved further that the resolution be formally conveyed to the council of the institution for their earnest consideration.

Mr. John Brook, in seconding, said that there had been many endeavours to carry the matter through; but he feared little could be done unless it was tackled by a united body of municipal engineers. The efforts of the National Association of Local Government Officers had not borne fruit, and further action was imperative.

The resolution was carried *nem. con.*, and the business meeting closed with a vote of thanks to the chair.

Members then proceeded to Churchdown to view the new sewage outfall works which had been designed by Mr. Henry J. Weaver. At the works they were met by Mr. J. H. Jones, the chairman of the Gloucester Rural District Council, and Mr. F. E. Weaver, surveyor and engineer to the council.

Mr. J. H. Jones, in welcoming the members, said that his council had been compelled by the county council to carry out a scheme for Churchdown parish, and they put its preparation in the hands of Mr. Henry J. Weaver. He believed that the works were as good as any to be found in the country, and Churchdown had every reason to be satisfied with the way Mr. Weaver had designed and superintended the works.

Mr. Henry J. Weaver then conducted the party over the works.

CHURCHDOWN SEWERAGE AND SEWAGE DISPOSAL WORKS.

The sewerage portion of the works comprise seven miles of sewer, laid mainly in 9-in. and 12-in. glazed stoneware pipes, but in cast-iron pipes when the sewer is above the ground or very near the surface. The stoneware pipes are jointed with a strand of gaskin and then cemented with a 1 to 1 mixture. The cast-iron pipes are jointed with lead wool. Manholes are placed at every change of gradient or line, and ventilation is provided by cast-iron columns. At the upper ends of the various sewers flushing chambers, of 150 to 200 gallons capacity, are placed, the water being syphonically discharged. The flushing is performed by springs where possible, but failing these by ordinary water supply pipes. The sewers are designed to serve a population of 7,000.

The sewage is dealt with at the outfall works in continuous flow tanks and revolving sprinklers, thus combining the anærobic and aërobic systems. The works are designed to deal with sewage for a population of 2,000, although at the present time it deals with sewage from fifty houses, or 250 population only. The site allows for any extension that may take place for very many years. The size and capacity of the various tanks are as follow: Detritus tanks and screening chambers, 7 ft. to 3 ft. 9 in. deep, capacity 540 gallons; storm-water or overflow tanks, 23 ft. 6 in. by 8 ft. 9 in. by 4 ft. 9 in., combined capacity 10,500 gallons; septic tanks, 40 ft. by 9 ft. 3 in. by 5 ft., capacity 10,500 gallons each; dosing chamber, 18 ft. 6 in. by 17 ft. by 1 ft., capacity 1,960 gallons; and humus tanks, 21 ft. by 6 ft. and from 2 ft. 9 in. to 2 ft. deep capacity, 3,500 gallons. The filter-beds have a capacity of 300 cubic yards, and are 4 ft. deep with a diameter of 59 ft. The whole of the sewage gravitates to the outfall, and no pumping is necessary, and the pipes are laid at such levels that the whole parish can be drained. The special features of the scheme are the long length of outfall, or trunk sewers, the manner in which the sludge is dealt with, and the easy working of the whole installation, which is managed by one man in one and a half days per week. The total cost of the scheme was under £12,000, and the work was carried out for the contract sum, there being no extras.

A number of questions were asked by the members and satisfactorily replied to by Mr. Weaver.

Mr. Shorland moved a vote of thanks to the chairman for his attendance that day and for the permission given to visit works which so appealed to the municipal engineer. They seemed to him as near perfection as was possible, and the council need apprehend no trouble in the future. The questions he had asked were not in the nature of criticism, and were put simply for the purpose of drawing useful information beyond that conveyed in Mr. Weaver's very excellent notes.

Mr. John Brook, in moving a vote of thanks to Mr. Weaver, expressed his pleasure at having seen such excellent works, works which were not only doing all that was required of them, but were ready to do a lot more. The effluent was absolutely clear. That there had been no extras over and above contract price was a unique feature, and the engineer (Mr. Weaver) must have evinced exceptional interest

in the works. Everything had been carried out with a view to future development.

The votes having been duly carried,

Mr. Jones responded, expressing the gratification he felt at being present to inspect the works in such able company. With him, such works came to his notice but once in a lifetime, whereas to the members of the institution they were within the ordinary course of things. He was glad to have heard the very favourable comments passed, and these but confirmed his opinion that the Gloucester Rural District Council were deeply indebted to Mr. Weaver for the excellent way in which he had executed the work that had been entrusted to him.

COUNCIL MEETING.

At a meeting of the council of the Institution of Municipal Engineers, held in London on September 27th, seven applicants were recommended for admission to membership and one for admission to associate membership. (Under the by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days). Among the applicants whose names had been duly published, ten were admitted to membership and one to associate membership.

The final draft of the regulations to govern the administration of the Mutual Aid and Defence Fund was approved, and the secretary was instructed to have copies printed for circulation.

The drafting of the annual report of the council was placed in the hands of the president and secretary.

The programme of the forthcoming annual meeting will be issued with the next report of council meeting.

The next meeting of the council will be held in London, on Wednesday, October 25th.

City Council and Coal Prices.—At Tuesday's meeting of Worcester City Council the half-yearly tenders for coal were stated to be in some cases practically 100 per cent in advance of pre-war rates. The town clerk pointed out that the Act limited the price only at the pithead, and another Act was apparently needed to limit the price charged to consumers. It was decided to call the attention of the Local Government Board to the prices, and to ask the Government to assist local authorities, by legislation if necessary, to secure coal at reasonable prices.

FOR OTHER ADVERTISEMENTS

See End of Paper.

HARROW-ON-THE-HILL URBAN DISTRICT COUNCIL.

Wanted in the Surveyor's Department, a Clerk (male or female) with a knowledge of figures, shorthand and typewriting. Applications, stating age, qualifications and salary required, together with copies of testimonials, to be sent to Mr. J. P. Bennetts, Engineer and Surveyor, Harrow, on or before 12 noon, October 16th.

JOHN STRACHAN,
Clerk.

Harrow. (3,119)

COOKHAM RURAL DISTRICT COUNCIL.

Applications are invited from gentlemen over military age, or ineligible, for the appointment of Temporary Highway Surveyor. Such appointment will be for a period of three months certain, and thereafter subject to a month's notice on either side.

The salary will be at the rate of Two Guineas weekly. The candidate appointed must be a cyclist—preferably a motor cyclist—and an allowance will be made for the upkeep of a cycle.

Applications, endorsed "Highway Surveyor," stating age, experience and particulars of appointments held, accompanied by copies of not more than three testimonials of recent date, should reach me by Tuesday, the 17th day of October, 1916.

(By order)
T. W. STUCHBERY,
Clerk to the Council.

Council Offices,
1 Park-street,
Maidenhead.
October 2, 1916. (3,118)

CLERICAL WORK or Book-keeping, in any position of trust, required by a good business man. Good references; ineligible; in or near Guildford; disengaged.—C. V., c/o Smith's Bookstall, Railway Station, Guildford. (3,117)

PERSONAL.

Mr. J. H. Drew has taken up his new position as borough surveyor of Grantham.

Mr. Thomas McAuliffe has been appointed surveyor to the Listowel Urban District Council.

Mr. E. F. Willson, surveyor to the Kingsbridge Rural District Council, has been appointed surveyor to the Alresford Rural District Council.

Captain W. Townsend Fletcher, Dorsetshire Regiment (county surveyor of Dorsetshire), who was formerly on the staff of Mr. H. T. Wakelam, county engineer of Middlesex, for some years, has just been appointed to a deputy military governorship in India.

Major W. H. Prescott, Royal Engineers, who in civil life is engineer to the Tottenham Urban District Council, has, owing to the illness of the clerk, stated that he would be willing to place himself at the disposal of the council if a resolution was passed by that body making the request. This being so, the council have forwarded to the Secretary of State for War a request for the release of Major Prescott from his military duties at the earliest possible opportunity.

Mr. Wallace E. Riche, general secretary of the Roads Improvement Association, has, we understand, joined the Artists' Officers' Training Corps, and the council have appointed Mr. James D. Haworth, of the firm of Major Tulloch and Haworth, consulting and civil engineers, of 28 Victoria-street, Westminster, S.W., as acting secretary during his absence. Mr. Haworth will still continue in practice with his firm. All Mr. Riche's male assistants, both at headquarters and the various branches, have for some time been on active service. All communications to the Roads Improvement Association should be addressed to Mr. Haworth, at the headquarters of the association, 15 Dartmouth-street, Westminster, S.W.

OBITUARY.

Mr. J. Ennals, for many years highway surveyor to the Lexden and Winstree Rural District Council, died recently, we regret to state, somewhat suddenly, at the age of seventy-five.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Wigan T.C. (September 27th. Mr. W. O. E. Meade-King).—£3,515 for works of sewerage for the Poolstock and Worsley Mesnes districts.—It was stated by the town clerk (Mr. W. H. Tyrer) that the proposed works had become absolutely necessary owing to the condition of the existing sewers. The position in regard to sewers in Wigan was different from the position in most other boroughs in the country, for, being a mining district, the sewers could not be expected to last as long as sewers would, say, in Southport or in the South of England. The borough engineer, Mr. A. T. Gooseman, explained the plans.

APPLICATIONS FOR LOANS.

Dudley T.C.—£1,430 for street improvement works.

Hebden Bridge U.D.C.—£450 for an additional electricity cable.

Ilford U.D.C.—£10,000 for electricity plant.

Lancaster T.C.—£28,000 for the purpose of the gas-works.

Rawtenstall T.C.—£400 for additional switchgear for electricity purposes.

LOAN SANCTIONED.

Bedford T.C.—£4,072 for the electricity undertaking.

Municipal Waterworks Association.—At the fifth annual meeting of this body, which is to be held to-day (Friday) at the offices of the Metropolitan Water Board, Savoy-court, Strand, London, W.C., a paper entitled "Notes on the Defence of the Realm (Acquisition of Land) Bill" will be read by Mr. C. G. Henzell, M.Inst.C.E., waterworks engineer to the Leeds Corporation, and one entitled "Recent Cases of General Interest Affecting Water Supply Undertakings," by Mr. Walter Moon, solicitor to the Metropolitan Water Board. The chair will be taken at 2 p.m.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Llandudno U.D.C.—The engineer, Mr. E. P. Stephenson, has received instructions to prepare a scheme for the provision of an open-air bathing place.

Nantyglo and Blaina U.D.C.—The council have accepted the proposal of a number of their representatives and the representatives of the Abertillery District Council that the Housing and the Sanitary Committees of both councils, with the respective medical officers and clerks, form a committee to prepare a scheme for a proposed joint hospital to serve both districts. The committee will submit a report to both councils for consideration.

HOUSING AND TOWN PLANNING.

Annfield Plain U.D.C.—The council have informed the Durham County Council that they will be prepared to commence a housing scheme as soon as the sanction of the Local Government Board can be obtained to a loan.

MOTOR TRANSPORT.

Millom U.D.C.—The tender of Robey & Co., Limited, at £756, has been accepted for the supply of a steam wagon.

Newark T.C.—A steam traction engine and two trailers are to be purchased for the haulage of road materials.

Tynemouth T.C.—It was reported that the town clerk, in the usual course, made application to the "priority branch" of the Ministry of Munitions for a certificate preparatory to an application being sent to the Local Government Board for sanction to borrow £1,500 for the purchase of a new fire engine. The reply of the Ministry of Munitions suggested that a second-hand fire engine was good enough, and that the town council should act accordingly. The Watch Committee reported that they now had the tenders in hand for the proposed new engine, and they were determined that they would either have a new engine or make what they had do.

PARKS AND OPEN SPACES.

Llandudno U.D.C.—The council have accepted the tender of Mr. S. Hughes, £650, for the construction of the second nine holes of the municipal golf course at Maesdu.

REFUSE COLLECTION AND DISPOSAL.

East Ham T.C.—The borough engineer, Mr. E. W. Beris, has been instructed to purchase a magnetic separator for the purpose of abstracting metals from the clinker refuse.

Worcester T.C.—The Streets Committee advise that the collecting of refuse paper should not be undertaken by the city council, but should be left to private enterprise. They also recommend the sale by the various departments of the useless refuse paper they have in their offices.

ROADS AND MATERIALS.

Bristol T.C.—The city engineer, Mr. L. S. McKenzie, has received instructions from the Watch Committee to whiten pavements and lamp standards. In the course of a discussion of the matter at the Sanitary Committee, Mr. King suggested that paint should be used; it would not wash off by rain. The city engineer said there was a distemper which would not wash off. Mr. R. C. Stephens asked if a luminous paint could be used. The city engineer: I have tried a luminous paint in front of the Victoria Rooms and on Redland Green, and I do not think it is a success. I do not know whether there is a better paint. I have had a quotation at £5 10s. a gallon, which is rather a stiff price for paint.

Carlton U.D.C.—The Local Government Board wrote refusing their sanction to the council to borrow £300 for the purchase of four houses for the improvement of Main street, on the ground that it was not a case of pressing necessity, or for public health, or war requirements. The question of purchase, together with a recommendation of the Works and Ways Committee that £450 be offered for some property in Main-street, was accordingly deferred.

Chelmsford T.C.—The tender of Mr. B. H. Hale, of Romford, at £91, has been accepted for the kerbing of certain main roads.

Cork C.C.—The town council have been requested by the county council to lay asphalt or wood paving in the street behind the court-house.

Coventry T.C.—It is proposed to purchase land at a cost of £337 for the purpose of making an approach road from the Stoke Heath housing site to North-street.

Devon C.C.—As the result of an interview which the clerk had with the Road Board, it was stated that the board had made an additional grant to the council of £1,818.

Dewsbury T.C.—The Corporate Property Committee recommended the town council to purchase certain properties between Wellington-road, Webster Hill, and Old Westgate for a widening improvement.

Easington R.D.C.—It has been decided to co-operate with Hartlepool Town Council in the matter of the Durham coast road scheme, to the extent of forwarding a report to the Local Government Board.

East Grinstead U.D.C.—The council have agreed to a widening scheme of the road at Felbridge, provided the Godstone Rural District Council agree to pay half the cost.

Erith U.D.C.—The Road Board have promised to contribute £1,000 towards the cost of repairing Abbey-road.

Godstone R.D.C.—To the Highways and General Purposes Committee the surveyor, Mr. G. E. Crowter, reported that the works carried out on behalf of the Road Board at Aldershot had been completed. In connection with the work, workmen's wages had been saved to the extent of £120, and the hiring of the tractor had brought in £200.

Lancaster T.C.—A portion of East-road is to be re-laid, at an estimated cost of £2,223.

Mutford and Lothingland R.D.C.—A letter has been received from the contractors for granite stating they regretted that, in the circumstances due to the war, they would not consider themselves liable under existing contracts which terminate on March 31, 1917, in the event of failure to supply granite to the council.

Portland U.D.C.—It has been agreed to obtain a quantity of granite from the Channel Islands at a freightage of 8s. 6d. per ton, an advance of 1s. per ton upon the freight paid hitherto.

Stockton R.D.C.—The highways surveyor, Mr. W. Heslop, reported that after consulting with the chairman he had placed the council's 10-ton road roller at the disposal of the Road Board for the use of the military authorities in France. The board had agreed to replace the roller with a new one as soon as practicable.

Tottenham U.D.C.—A sum of £14 has been voted to be spent in providing oil-skin coats, south-westers, and leggings for the roadmen.

West Ham T.C.—The town council have agreed conditionally to carry out the proposed extension of Newland-street, Silvertown, for the Port of London Authority, for the sum of £1,145.

SEWERAGE AND SEWAGE DISPOSAL.

Ardsley U.D.C.—The surveyor, Mr. J. Morley, has been instructed to submit a scheme for putting down an electric pump at the Brodilley sewage works.

East Grinstead R.D.C.—The surveyor, Mr. C. Turton, submitted a report on the repairs to the filter beds at the outfall works, and it was agreed that steps be taken to acquire the additional 1 acre of land, as agreed with the military authorities, with a view to the present works being continued pending the con-

sideration of a scheme for reconstructing the works. It was also decided that the surveyor should prepare plans for the reconstruction of the Forest Row sewage disposal works.

Epsom R.D.C.—The council will consider at the next meeting proposals with respect to the boundaries of land to be conveyed to the council with the sewage works.

Mutford and Lothingland R.D.C.—Plans and estimates have been approved of sewer extension works.

Skipton R.D.C.—The surveyor, Mr. A. Rodwell, reported that they had had complaints from the Rivers Board as to the effluent from the Glusburn sewage works. He had written the Rivers Board that the price of aluminoferric was very high, and, taking into consideration the indifferent results they had been getting, he suggested that they should suspend chemical treatment for a time, or until conditions became normal. He received a reply from the chief inspector (Dr. H. Maclean Wilson) recommending the use of lime at present instead of aluminoferric. It would take a little more trouble to add the lime, but they should get quite as good results. It was decided that the surveyor should go into the matter and get prices for lime-mixing plant.

WATER, GAS, AND ELECTRICITY.

Bangor U.D.C.—A Provisional Order has been sanctioned providing for the purchase of additional land for gasworks extension.

Blackpool T.C.—New plant is to be installed at the gasworks at an estimated cost of £1,800.

Finchley U.D.C.—The Gas Light and Coke Company have announced that the price of gas for street lighting (except where a fixed annual charge is made under contract) has been reduced from 2s. 10d. to 2s. 8d. per 1,000 cub. ft., as from the June quarter, 1916.

Port Glasgow T.C.—The town council have decided to promote a Provisional Order for obtaining the powers necessary to raise the embankment at Auchendores reservoir, in the parish of Kilmacolm; to abstract water from Cunston Burn and Bogside Burn; to construct additional filters at Parkhill; and for any other purpose connected with such works. The scheme is estimated to cost £20,000, and to give an increased water supply equal to fifty days for the whole burgh.

Richmond (Yorks) T.C.—The Water Committee have been authorised to construct a storage reservoir, at an estimated cost of £600.

St. Austell R.D.C.—The question of improving the water supply at Mount Charles and Charlestown has been referred to the Water Committee.

Southampton T.C.—It is proposed to relay electric cables, at an estimated cost of £300.

Sunderland T.C.—An important scheme for the extension of the electricity works, which is estimated to cost £45,246, will be submitted to the town council.

Witham U.D.C.—Owing to the large waste of water and the heavy cost of pumping, the council have referred the question of the payment by meter for water other than that used for domestic purposes to the Waterworks Committee.

MISCELLANEOUS.

Egham U.D.C.—It was reported that the council were taking every step in their power to meet the wishes of the population as regards the cleaning of watercourses so as to prevent flooding. Many of the watercourses were in a very bad state, and it was estimated it would cost about £2,000 to clear them thoroughly to a uniform fall. As a first step, the council had decided to deal with the Milton Park district and to lay a new drain from Egham Hill to Langham Pond to relieve the area between the town and Stroude.

Liskeard R.D.C.—Mr. J. R. Sobey, surveyor for the southern division, who has held office since the formation of the council, and prior to that under the old highway board, wrote that he could not accept the council's offer to increase his salary by £25, making it up to £145. He asked that he be put on an equal mileage basis with the northern division surveyor, which would bring his salary up to £170. He had given three months' notice, which would expire on the 8th inst. After a short discussion the matter was adjourned for a month on the understanding that if the council would not accede to his request he should remain in office until Christmas at the rate of £170 per annum.

Torquay T.C.—A special report by the deputy borough surveyor, relative to the proposed works at the Torre Abbey foreshore, expressed the opinion that the placing of boulders at the toe of the wall would not meet the case, and recommended that the best method to overcome the difficulty was by constructing a series of concrete steps similar to the bathing platforms already existing. This opinion was supported by the borough surveyor, Mr. H. A. Garrett, with whom he had communicated. Special consideration should be given to the questions of scarcity of labour and abnormal costs of materials in coming to a decision as to carrying out the work. The matter was carefully considered by the committee, and it was resolved that an approximate estimate of the cost of this work per 100 ft. be prepared, and that the matter be referred to the council to determine what length, if any, shall be done.

L.G.B. INQUIRY EXPENSES.

THE LOCAL AUTHORITY'S SHARE.

At the last meeting of Chipping Sodbury Rural District Council the clerk stated that, in accordance with instructions, he had written to the Local Government Board asking how they arrived at £7 0s. 8d. as the cost of an inquiry held with reference to an application to borrow money for the purchase of Bury-hill quarry, and had received a reply stating that part of the salary of the inspector was always included in any case of inquiry which might arise through the application of a local authority. The charge also included the inspector's first-class railway fare, motor hire, and hotel accommodation in Bristol.

The council agreed to pay the bill.

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

Edinburgh's Reduced Gas Bills.—Official figures supplied by the Edinburgh and Leith Gas Commissioners show that during the period in which the Summer Time Act was in force there was a reduction in the output of gas of 41,000,000 cub. ft. It represents a reduction of 8 per cent compared with the same period of last year, and the saving to the consumers is £7,000.

Trout Fishing and Tar-sprayed Roads.—At the meeting recently of the Conway Fisheries Board complaint was made that the past fishing season had been a very poor one, and it was asked whether the tar-spraying of the roads by the Carnarvonshire County Council, or the laying down of tar-macadam, had anything to do with this. The watcher replied that he took particular notice of the tar-spraying in Bettws-y-coed, Capel Curig, and Dolwyddelan, and he had not seen any bad results, because there was plenty of water in the river. Mr. Thos. Griffith pointed out that the trout fishing was also poor in the lakes, and that could not be due to tar-spraying the roads.

Edinburgh and Electric Tramways.—A report prepared by Mr. A. H. Campbell, the city engineer, in consultation with two English officials, answers in the affirmative the question "whether a new system of tramways could be running in Edinburgh six hours after midnight on June 30, 1919, without the city having received any facilities from the Edinburgh and District Tramway Company." The adoption of the overhead system is recommended as the cheapest and most convenient, and as the one which would lend itself not only to extensions into the country, but also to linking up with the existing electric systems of Leith and Musselburgh. For Princes-street it is recommended that before introducing the conduit system there overhead wires should be installed on the south, or Garden, side of the street, where they will be largely hidden by the foliage of the trees. If, after practical experience of that, the citizens make up their minds not to have it, the overhead can be taken down and the conduit introduced. It is emphatically declared that it is not advisable to continue the cable tramways for the city or for any part of it after the expiry of the tramway lease.

Municipal Engineering Work at Stowmarket.*

By G. W. LINGWOOD, A.R.S.I., Surveyor to the Urban District Council and Joint Sewerage Committee of the Stowmarket Urban and East Stow Rural District Councils.

The town of Stowmarket is situated on the old turnpike now the main road between Ipswich and Bury St. Edmunds, twelve miles from the former town and fourteen from the latter. The principal works in the town and adjacent country are leather belting works, leather works, chemical works, iron foundry, engineering works, and a large malting industry.

GENERAL STATISTICS.

Area, 1,033 acres.

The population in 1901 was 4,162; and in 1911 had reached 4,230.

In 1915 the number of inhabited houses was 1,072, and the rateable value £16,513.

A 1d. rate brings in £55. The urban rate is now 4s. 6d. in the £ and the poor rate 5s. 4d in the £.

Loans outstanding March 31, 1916: For sewerage, £5,488 8s. 10d.; for depot erection, £800; cemetery and surplus land, £598 1s. 11d.; total indebtedness, £6,886 13s. 9d.

ROADS.

The length of sub-divisional roads proposed to be made main is 3 miles 1 furlong 2 chains, and the council receive a grant of £320 per annum from the East Suffolk County Council towards their maintenance. The whole of the above length has a granite surface, with the exception of 400 yards, which is surfaced with Wymondham flints. The length of other roads is 3 miles 6 furlongs 2 chains, and private roads not made up, 5 furlongs. The total length of all roads in the urban district is 7 miles 4 furlongs 4 chains. The Ipswich and Bury road is a through road to Newmarket and Cambridge, and has to carry a considerable amount of traffic and hauling.

The Private Streets Works Act was adopted in May, 1912. At present the roads are not made up, the work being left in abeyance owing to the war.

SEWERAGE.

Schemes were prepared by Messrs. Pollard and Tingle in 1893. In 1898 the council decided to join the East Stow Rural District Council for a joint sewerage scheme, which had been prepared by Messrs. John Taylor, Sons & Santo Crimp, for the disposal of the sewage of the urban part of the adjoining parishes of Stowupland and Combs. In that year main intercepting sewers were laid north and south of the town, parallel to the River Gipping, to intercept the high-level sewers from discharging into the river. Very bad ground was encountered on the Stowmarket side. The total length of this sewer was 1,420 yards, and the cost of laying was £5,219. The population was taken at 5,000 persons in the urban district and the sewage 20 gallons per head per day, giving a daily dry-weather flow of 100,000 gallons per twenty-four hours. The whole of the sewage has to be pumped up to the sewage farm. The council paid the East Stow Rural District Council five-sixths of the cost of the pumping station, machinery, rising main, land and buildings, and they borrowed a total sum of £11,500. The machinery cost £1,100, pumping station site £240, 30 acres of land £1,700. The total length of sewers in the urban district is 4¼ miles.

In 1902 the author, as surveyor to the council, reported on the condition of the main intercepting sewer, and advised the construction of manholes in places of the existing lamp-holes, and also sealing the manhole covers and providing ventilating shafts 50 ft. high. Special tackle was also constructed to deal with the blocking up of the sewer. This consisted of winches, steel ropes and steel buckets from 6 in. to 12 in. in diameter, also circular brushes of the same diameter. 1,610 ft. of sewer was cleaned out at a cost of £39 17s. 6d. The author has reconstructed 1,590 yards of old high-level and low-level butt pipe sewers, at a cost of £1,580. The total length of butt pipe sewers in the district at the present time is about 1,900 yards, and of brick sewers 1,440 yards.

In 1913 a scheme was prepared to deal with the surface water and a portion of the old sewers, at a cost of £2,500. The Local Government Board were not satisfied that the scheme would deal with the whole trouble. In the same year Mr. G. Midgley Taylor, M.INST.C.E., was asked to report on the whole of the sewerage system, and also on the plans prepared by the author. The scheme was approved, with slight alterations, and it was decided to embody the whole of the sewers in the amended scheme after conferring with the Local Government Board. A further scheme is being prepared by the author and Mr. G. Midgley Taylor, M.INST.C.E., has been appointed consulting engineer. The work is left in abeyance owing to the war. The cost was estimated at about £6,000.

SEWAGE FARM AND PUMPING PLANT.

The whole of the sewage from the Stowmarket urban district and Stowupland rural district gravitates to the main pumping station, with the exception of the Ipswich-road sewer in the urban district, which gravitates to the electrical pumping station at Combs, in the rural district, and together with the Combs sewage it is then pumped back to Stowmarket, thence it flows to the main pumping station. Night storage is provided for the night flow of sewage in all three districts, which comprises 30-in. and 24-in. cast-iron pipes. In Stowmarket 4,000 cubic ft. was allowed for the night store. The sewage is then pumped up through an 11-in. rising main, 3,000 ft. in length.

The pumping plant is in duplicate, and consists of two gas engines with three-throw pumps (which were each sold to give twenty-two maximum b.h.p. on town gas and 18·5 on suction gas, and to run at 180 revolutions per minute). In 1913 the author advised the erection of a suction gas plant, and in 1911 a 24-h.p. gas plant was installed, at a cost of £133 6s.; the electric ignition to each engine cost £31 5s., and the building cost £58. In the first year the plant saved £50. In 1915 the total cost to run the suction gas plant was £91 19s. 7d., and to run it on town gas would have cost £173.

Each engine is designed to lift 70 cubic ft. per minute, and when tested they each threw 26,520 gallons per hour against a head of 90 ft., including friction.

The sewage passes through two upward filters, size 20 ft. by 16 ft. by 4 ft. 3 in. and 4 ft. 7 in., and is filtered through shingle before it flows on to the land. The sludge is run off from time to time into trenches 22 yards long, 4 ft. wide and 4 ft. deep. About 800 cubic yards of sludge was disposed of in 1915, and about 98,254,000 gallons of sewage and surface water was pumped up on to the farm from the three districts. The area of the farm is 30 acres, and the crops grown are beet and osiers.

The committee kept their own horses, but the author advised putting the work out to contract, which is now done on a schedule of prices. Last year the prices were increased 15 per cent. The saving effected in putting the work out to contract was about £70.

The Combs and Stowupland sewerage schemes were designed by Messrs. J. Taylor, Sons & Santo Crimp, in 1896. The pumping station and sewers at Combs cost £1,272. The electric pumps were installed in 1900 by Mr. Napier Prentice, engineer to the Suffolk Electricity Supply Company, Limited; they consist of three-throw plunger pumps, 4 in. diameter, 6 in. stroke; each pump delivers 5·5 cubic ft. against a head of 30 ft. The pumps are coupled direct to series wound motors with wormgear reduction, the motors running 500 revolutions per minute and the pumps about 50 revolutions per minute. The cost of the pumps, motors floats and automatic switchgear was £431 in running order. The Stowupland sewerage scheme cost the East Stow Rural District Council £3,728. The total cost of the two schemes was £5,000.

OSIER CROP.

In 1915 the 6 acres of osiers cost £25 13s. 4d. to hoe, to cut 3s. 6d. per score bunches tied 42 in. round. There were 1,107 bunches on the 6 acres. The cost to plant, double digging, is 2s. 3d. per rod; setts 13 in. long are planted 14 in. by 16 in. apart, or about 19,000 to the acre. One bunch 42 in. round will make 1,000 setts. Two men will plant half an acre in a day, and one man will cut 3,000 setts in a day.

In 1914 the 6 acres cost £21 and were sold for £48. The highest price given for the 6 acres of osiers was £96. The author has made a clear profit of £84 on 16 acres of osiers and beet. He has planted

* From a paper submitted at an Eastern Sub-District (Norfolk, Suffolk, and Cambridge) meeting of the Institution of Municipal and County Engineers held at Stowmarket on Saturday last.

3 acres of osiers since he took charge of the farm in 1902, and has replanted 3 acres.

BEET.

In 1915 the cost to grow 11 acres of beet was £45 12s. 1d., and the cost to pull and cart them with the carriage was £57 3s. 7d. There were 152 tons 10 cwt. on the 11 acres, which sold for £111 10s. 9d., and the expenses were £102 15s. 8d., profit £8 15s. 1d.

In 1914 the crop cost £54 18s. 7d. and was sold for £63; profit, £9 18s. 7d.

CULTIVATING CONTRACT.

This contract was for three years, commencing May, 1913.

Ploughing at per acre—not less than 1½ ac. per day and not less than 5 in. deep ...	17/6	
Ridging per acre 30 in. apart...	12/-	
Harrowing or cronning, 2 horses	1/8	per ac.
Rib rolling „	1 9	„
Light rolling 1 horse	1 2	„
Horse hoeing „	1 2	„
Drilling corn	1 2	„
„ beet	2 -	„
2 horses, man and plough at per day ...	12 -	
„ man and tumbril	10/6	
1 „ do.	7/6	
Ploughing without breast, 1 horse and plough	9 6	per ac.
Ploughing between ridges	4/-	„

15 per cent increase was allowed in 1915. This contract expired in June, 1916.

The land is periodically steam cultivated 12 in. deep, and the contract price is 12s. per acre done twice, but it does not include the coal and carting of water. Inclusive of coal and water the price works out at 22s. per acre, the amount of coal used on 11 acres being 2½ tons.

WATERWORKS.

The waterworks belong to Messrs. Greene, King & Sons. The water is pumped from two borings in the chalk, the capacity of the reservoir is 200,000 gallons. The charges are based on the rateable values of the properties. The hydrants are the property of the council. In 1905 the council decided to negotiate for the purchase of the waterworks, and Mr. H. Miller, M.INST.C.E., of Ipswich, was called in to report on the works and their value, and the purchase price was fixed at £9,500. The council made application to the Local Government Board to borrow £10,000, and Mr. R. H. Bicknell, M.INST.C.E., held the inquiry in March 1907. The loan was sanctioned, but the council decided not to purchase. At that time the company were paying a 5 per cent profit.

GASWORKS.

The gasworks are the property of a limited company. In 1913 the council entered into a seven years' contract for £266 13s. for lighting the town. The lamps, ninety-four in number, are lighted from August 15th to May 15th—78 ordinary lamps half an hour after sunset to 11.15 at night, and sixteen permanent lamps half an hour after sunset till half an hour before sunrise. Additional lamps are charged at £2 8s. 3d. and £4 7s. per annum respectively. The ordinary lamps are 80 candle power and the permanent lamps 100 c.p. All lamps, standards, pipes and fittings are the property of the gas company, who have to renew all lanterns, burners, pipes and standards, and keep them clean and in perfect order. Since the outbreak of war the company have generously met the council, and have reduced the contract price of £275 to £90. The price of gas is 4s. 7d. per 1,000 —which will probably be increased.

ELECTRIC LIGHT.

The electric light works are owned by the Suffolk Electricity Supply Company, and the charges per unit vary from 8d. to 1d., according to the amount used. The voltage has been recently altered from 100 to 200, which necessitated the altering of all lamps; the company paid half the cost of the new lamps, taking the old ones back. Recently the works have been considerably improved and a new plant has been installed.

Housing and Town Planning in Wales.—Steps are being taken by various local authorities to improve housing conditions in certain portions of the Monmouthshire Eastern Valleys, and the urban authorities of Pontypool and Blaenavon have decided to prepare town planning schemes "to become operative at the earliest opportunity."

MUNICIPAL SCHEMES AFTER THE WAR.

COALVILLE U.D.C.—The council on Tuesday decided to invite landowners of the district to state upon what terms they would sell land for the erection of workmen's houses, and to inform the Local Government Board that after the war the works they proposed to carry out included the erection of fifty workmen's dwellings, various sewerage items, and a supplementary water supply.

EASTBOURNE T.C.—A provisional list has been approved of public works which it is proposed to carry out at the conclusion of the war. One scheme is for a wide coastal road between Eastbourne, Bexhill, and Hastings, the cost of which, it is hoped, will be borne mainly by the Government.

GOLCAR U.D.C.—The clerk has been instructed to forward to the Local Government Board particulars of works proposed to be executed after the war. The chairman said the chief works would be the East Ward sewerage scheme and the extension of the Crimble sewage works.

HANWELL U.D.C.—The surveyor, Mr. S. W. J. Barnes, has been instructed to include in the proposed works the underground convenience in the Broadway, the isolation hospital, wood-paving margins of Uxbridge-road, and the making-up of roads for which material had not been obtainable during the war.

NEWHAVEN R.D.C.—The council suggest that the first work to be taken in hand after the war should be the completion of the Newhaven to Seaford road.

RETFORD R.D.C.—It is proposed to proceed with the Ranskill drainage scheme and a water supply for Ragnall.

SHOREHAM U.D.C.—It was stated that the following works were under consideration at the commencement of the war: Sewerage scheme; footbridge over the river; reclamation of land in the river. The following works have been mentioned since the war: Rebuilding Norfolk Bridge and the improvement of Shoreham Harbour.

WELLINGTON R.D.C.—The council have several schemes under consideration, the most important being the construction of sewers at Ketley.

Motor Transport: Committee of Organisation.—With regard to the formation of the committee, authorised by the Secretary of State for War, to deal with the question of the organisation of motor transport in the country on a voluntary basis, in connection with the National Volunteers, it is interesting to note that of the six members appointed three—viz., the Hon. A. Stanley, C.B., M.V.O., M.P., Mr. W. Joynson-Hicks, M.P., and Major Steveson Cooke—are members of the council of the Roads Improvement Association, the first two named gentlemen being vice-presidents of that body.

Revenue from Waste Paper.—The Liverpool Town Hall waste paper scheme, which was put into operation on a very moderate scale towards the beginning of June, has now developed a dimension and a turnover which (the *Liverpool Post* states) many old-established businesses would be proud of. The public generally, and the commercial houses in particular, have supported the venture most splendidly, and the danger now is not dearth of material, but a shortage of accommodation and labour for dealing with it. As a result of four months' operations, a first contribution of £500 is now available towards the Roll of Honour Fund.

Ireland and Road Board Grants.—The following resolution was passed on Friday last at the annual conference of the Association of Municipal Authorities of Ireland: "That, inasmuch as clause 17 of the Development and Road Improvement Funds Act, 1909, defines the expression 'highway authority' in Ireland to mean the council of any county or county borough, thus prohibiting the Road Board from making direct advances to urban district councils in Ireland towards the improvement of existing roads or towards works of road improvement in an urban district, we, the Association of Municipal Authorities of Ireland, do make representations to the Irish Office and the leaders of the several Parliamentary parties with the view of securing such an amendment of clauses 8 and 17 of the Act as will place urban district councils on a like footing to the county and county borough councils."

Water Supply in the South Yorkshire Coalfield.

THE WATH-UPON-DEARNE WORKS.*

By J. H. DREW, M.INST.C.E.L., Late Engineer and Surveyor to the Urban District Council.

The Wath-upon-Dearne waterworks, of which the recent extensions are a development, were taken over by the urban district council in 1898 from the West Melton Waterworks Company, Limited.

For ten years or so after the purchase of the undertaking the water supply continued to be thoroughly satisfactory, but later its efficiency declined rapidly. The distributing system gave out signs of age, the incrustation of the pipes, which had been in the ground since the year 1858, had a marked effect on the pressure, and the higher levels of the township began to suffer shortage.

In addition to the rapid development of population common to the whole of the South Yorkshire coalfield, there has been a material addition to the area of supply by the inclusion of Adwick-upon-Dearne. The estimated population of the entire area of supply is 14,802, or an increase of nearly 75 per cent on the population which the council had originally to supply. On that ground alone the need for the recent extensions which have been carried out will be readily recognised, and in addition the provision of water-closets, public baths, and the use of water for trade purposes by the local brewery still further emphasises the need.

The council had an agreement with the Dearne Valley Water Company to give a supplemental supply of water, but this agreement terminated in 1903, and in lieu thereof the council decided to sink a borehole and erect a pumping station on the present site of our works. The system was one of air lift from the borehole to ground level and Worthington force-pumps to deliver the water from the pumping station to Wath Wood reservoirs. The cost of installing this plant, together with the 15-in. borehole, rising main, and a small reservoir of 175,000 gallons capacity was £5,200. In 1912 it was found that this source of supply was inadequate and the pumps could only deliver about 14,000 gallons per hour to the reservoirs. Since the installation of the new plant the old air lift and force pumps are retained as a stand-by plant in case of emergency or breakdown of the newer installation. . . . The whole of the district is now supplied from the boreholes in the pumping station.

There is an abundant supply of water in the vicinity of the council's pumping station, and approximately 1,500,000 gallons daily is taken within an area of ¾ mile of the boreholes by manufacturing firms and collieries, who derive their own supplies from boreholes and the pit shafts.

The old borehole is 15 in. diameter and 180 ft. deep, the new bore—which is 44 ft. distant and to the west of the original borehole—is 18 in. diameter, and 162 ft. deep. The boring of the recent borehole was done by Messrs. Potter & Company, at a cost of £367 10s., including the provision and fixing of 18-in. and 21-in. casing tubes to a depth of 92 ft. 6 in. for the 18-in. tubes, and 36 ft. 6 in. for the 21-in. tubes. The borehole is in the coal measures down to the depth of the "Oaks Rock," and is favourably situated and practically surrounded by faults which it is anticipated will protect the district from loss of the source of supply which might otherwise result from future colliery developments.

The thickness of the "Oaks Rock," which is the water-bearing strata, is 87 ft., and this rock is overlaid by gravel, clay, magnesium, limestone and drift of a thickness of 75 ft. The magnesium limestone has its outcrop towards the east at High Melton, and is of the Permean series; below the "Oaks Rock" is the Millstone Grit rock, having its outcrop in a westerly direction, towards Penistone and Wortley.

The water is of a high degree of purity, but of hard quality, being about 30 deg. total hardness (Clark's scale). For financial reasons and the brewing industry—which requires hard water—it has not been considered necessary up to the present to resort to softening.

The estimated population supplied to the end of the last financial year was 14,650, and the annual consumption 113,430,000 gallons, or 21·15 gallons per head per day, which is considered excessive by some people. Domestic and public consumption is equal to 18·54 gallons per head daily and 2·61 gallons per head for trade purposes. Careful night tests are made from time to time, and there is no serious leakage which would account for reducing the consumption to 12 gallons per head per day, which has been stated to be sufficient for the district. No waste water detecting meters have been installed, but this question is worthy of consideration by the council, and would certainly tend to prevent waste caused by leakages, provided proper nightly inspections were made from time to time.

The new extensions to the waterworks have been designed and executed under the supervision of the author at a cost of £12,023.

The total capital cost of the waterworks undertaking since its inception has been £39,559, and the debt outstanding on March 31, 1916, was £27,538 12s. 7d., so that £12,020 7s. 5d. of the capital has been paid off, with, of course, interest on the moneys borrowed in addition.

There is a deficit on the undertaking each year, after meeting all revenue and capital charges. From 1899 to date the total deficit has been £12,479 12s. 10d., or an average of £731 1s. 11d. per annum, which has had to be paid out of the General District Fund.

Despite the recent capital expenditure of over £12,000 to bring the undertaking up to present requirements, and with a considerable margin for future increased demands, the deficit for the year ending March 31, 1916, was only £380 18s. 4d., although additional repayment of principal and interest for that year amounted to £1,106 19s. 7d. This deficit was, therefore, £353 3s. 7d. below the average, while an increase in the price of coal amounting to 3s. 6d. per ton had to be met. The undertaking is now in a first-class state of efficiency, and when the original capital charges have been paid off it should prove a flourishing concern and a source of considerable revenue to the ratepayers.

Water has been sold for trade purposes at less than cost price to the ratepayers, and this should be avoided in future and a reasonable margin of profit allowed when entering into any agreement for the supply to any consumer by meter.

The extensions consist of a second borehole, a new and powerful pumping plant, a pumping station, 3 miles of new mains, and two reservoirs and sand filters.

After careful consideration the council, on the author's advice, decided to abandon the air-lift system of raising water from the bore, and to instal a high-class compound surface condensing differential waterworks pumping engine, with borehole and force pumps, by Messrs. Hathorn, Davey & Company, Limited, of Leeds. This plant, which is of an exceptionally economical type, in that it reduces wastage and duplication to a minimum, is of the most robust and substantial construction, designed for its particular work, and built to give the highest efficiency and durability in continuous service. The engine is capable of raising 25,000 gallons per hour, from a depth in the borehole of 155 ft., and forcing it against a statical head of 130 lb. per square inch (or 500 ft.), through a pipe line of 8 in. internal diameter, and not exceeding 7,500 ft. in length, or against a total forcing head of 510 ft., the total lift on the engine being therefore 665 ft.; the steam pressure at engine being 100 lb. per square inch superheated to 100 deg. Fahr. The plant has a brake-horse-power of 84. The volume of water to be lifted is 417 gallons per minute. The calculated velocity per second through the rising main is 3·2 ft. The size of the engine is exceedingly liberal, so that it will always be above its work, and will carry a considerable overload in case of an emergency—such as fire. Its maximum capacity is 30,500 gallons per hour, as compared with the normal requirements of 25,000, thus giving a reserve of 22 per cent in power.

The Wath water having a corroding influence on iron, the seats of valves, borehole bucket and clack, and working parts likely to be affected have been made in bronze at a slightly increased cost.

When tenders were being considered for the pumping plant, each firm was asked to state the steam required per p.h.p. of plant offered. Messrs. Hathorn,

*From a paper presented at a North-Eastern District meeting of the Institution of Municipal and County Engineers held at Wath-upon-Dearne on Saturday last.

Davey & Company, Limited, submitted considerably the highest tender, and despite this their offer was accepted. The author prepared a report upon each tender for the Waterworks Committee, dealing with details of construction and the probable running costs of each plant. Messrs. Hathorn, Davey & Company, Limited, stipulated the steam consumption for their plant per water horse-power per hour would be approximately 30 lb., in actual practice it has proved to be less than this estimate. The author prepared a table showing the annual repayment of capital charges upon each plant, plus the estimated running charges based upon steam consumption, capacity and labour required. On this basis, despite the larger capital outlay, the offer of Messrs. Hathorn, Davey & Company, Limited, to supply the plant at a cost

Interior of Receiving Reservoir, Wath-upon-Dearne, During Construction.
(Showing Hennebique reinforced-concrete columns, beams, and roof decking.)

of £2,264 was easily the best, and was accepted without hesitation by the council.

In this estimate the author calculated that after repayment of principal and interest on the loan borrowed upon this plant, a saving of at least £350 per annum would accrue in comparison with the cost of running the old air lift and Worthington force-pump installation. The actual result of the first year's work is a saving of £348, although the price of coal has been advanced 3s. 6d. per ton since the time of the calculation submitted to the council and the Local Government Board, and such an increase in the cost of fuel was quite unforeseen.

The new pumping plant has therefore done all that was expected of it, and has proved most economical. The amount of coal consumed by the old air lift and Worthington installation in 1914 was 1,460 tons, and in 1915 the new Hathorn-Davey plant only used 668 tons, or a saving of 772 tons. There was an increased consumption of water amounting to 9 per cent during 1915, and taking this into consideration the coal saved was equivalent to 820 tons, and including delivery at our present price of 13s. 3d. per ton the saving was £543 5s. for the year. Even neglecting the increase in consumption, the saving is £511 11s. per annum. There was also economy in labour at the pumping station in favour of the new plant amounting to £50. The total economies effected can be represented at £593 upon revenue account or running charges. The capital repayments of principal and interest at 4½ per cent upon the plant only amounted to £245 11s. 1d. for the year, which shows that after making allowance for the 9 per cent increased consumption the new plant has repaid its capital charges and saved £348 during the year ending December 31, 1915. Upon this basis, which the author has no doubt will be maintained with efficient management, the plant will pay for itself after four years' working. The Local Government Board allowed fifteen years for repayment of capital.

By a clause in the contract Messrs. Hathorn, Davey & Company, Limited, have to make good any part of the machinery which may prove defective in material or workmanship, and to replace any part which should fail through fair wear or tear, free of cost to the council, for a period of five years, after the ordinary maintenance period, or six years from the actual starting of the plant—viz., until January 1, 1921.

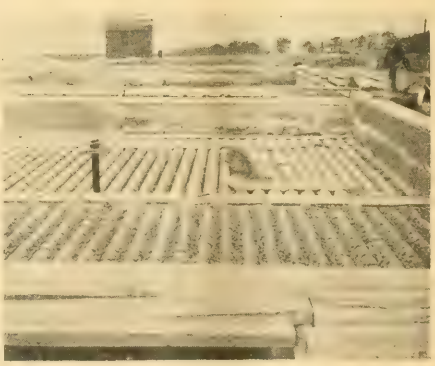
For the payment of a sum of £5 per annum the makers have agreed to send a man to draw the bucket and clack from the borehole once a year, and to replace the gutta-percha packing ring if necessary, so as to ensure the borehole pump doing its full duty.

Steam is supplied from two Arnold's Lancashire-type boilers, 30 ft. by 7 ft. diameter, to which Sugden's superheaters have been fitted. Each superheater is capable of raising the temperature of the steam from the boiler to which it is attached about 140 deg. Fahr., above the normal temperature of the steam at 100 lb. pressure per square inch, under ordinary working conditions, when evaporating 2,500 to 2,700 lb. per hour. One boiler is always kept in reserve while the other is under steam.

The new pumping station and foundations for the mechanical plant were constructed at a cost of approximately £700 by the council's workmen by direct labour. There is a Morris 5-ton overhead crane full length of the building.

With regard to the system of distribution, which has been enlarged, extended and improved by the laying of over 3 miles of mains varying from 4 in. to 8 in. in diameter, in certain parts of the district, subject to colliery subsidence and where cast-iron pipes were often previously fractured, some 2,800 lineal yards of 6-in. and 340 lineal yards of 4-in. steel Mannesman tubes have been laid. Analytical and chemical tests were made, and it was reported to the author that the water had about the same effect upon either cast-iron or steel tubes, and with the advantages of less risk of breakage owing to colliery subsidence, the author decided to give a trial to this class of water main. No breakages have occurred, and the outsides of the pipes were covered with jute and great care taken to protect the joints. Molten lead was used for jointing, and the lancets were of the type known as the rigid joint or long joint. The original rising main between the pumping station and the reservoirs was laid in a tortuous line, and added considerably to the friction head to be overcome in pumping. For a distance of about 400 lineal yards a new 10-in. main has been laid, in order to straighten the rising main and so ease the pressure upon the pumping engine.

New trunk mains have been laid to Newhill and West Melton to the west, and Wath and Adwick-upon-Dearne to the east. The main to Newhill and West Melton is 8 in. reducing to 6 in. in diameter, and this will discharge at the rate of 400 gallons per minute at Newhill, with a velocity of 3 ft. per second, while the 6-in. main to the east will deliver at the rate of 220 gallons per minute with a similar velocity and a "friction head" of 29 ft. The discharge from



Sand Filters in Course of Construction at Wath-upon-Dearne.
(Showing under-draining with Naylor's patent tiles.)

the two mains is therefore 892,800 gallons per twenty-four hours at the stated velocity, which could be increased without appreciable loss of head in case of fire or other emergency.

The highest parts of the district supplied are Newhill (234 ordnance datum), and Brampton (215 ordnance datum).

An interesting feature of the scheme is the construction of two new reservoirs and two sand filters. Prior to the installation of these reservoirs, the reservoir capacity was only 280,000 gallons per day, or less than a day's supply. The receiving reservoir accounted for 175,000 gallons and the service reservoir for 105,000 gallons. This storage accommodation has now been increased by the construction of a

receiving reservoir, with a capacity of 354,000 gallons, and a service reservoir to hold 270,000 gallons; a total capacity of 624,000 gallons, and a grand total of 904,000 gallons, equal to a three days' supply. The contract for the reservoirs and filters was placed with and efficiently carried out by Messrs. Yorkshire Hennebique Contracting Company, Limited, Vaudrey Works, Leeds, at a cost of £5,385 viz.: High-level reservoir (354,000 gallons), £2,693 9s. 8d.; sand filters, waste-to mains and appurtenant works, £712 5s. 1d.; service-reservoir (270,000 gallons), £1,979 10s. 6d.; total, £5,385 5s. 3d.

The area of new sand filters is 338 super. yds., and the old filters 390 super. yds., making a total area of 728 square yards. It will allow of filtration at the rate of 420 gallons per super. yard per twenty-four hours, and this rate can be increased if necessary to allow of one of the filters being put out of operation for cleaning. Sufficient aëration of this deep well water is necessary to get rid of the hydrated oxide of iron in suspension, and this aëration is obtained by a cascade into the reservoirs and the method of distribution upon the filters. The new filters are automatically controlled, so that the "head" of water upon the surface can be regulated to suit the conditions, from 1 in. up to 18 in. The normal working "head" is about 9 in.

The reservoir site is a very suitable one at the highest elevation of any in the district. There is certainly some risk of subsidence, owing to colliery workings, but this applies to any part of the district, and in fact, to almost every part of South Yorkshire. The old reservoirs are watertight, and the new ones proved to be quite watertight after repeated tests. The reservoir floors and walls are of 6 to 1 cement concrete, brick-lined, with a cradle of clay 1 ft. thick surrounding the whole structure. Ventilation is provided by usual type ventilators, with slots and inside standpipe, secured to the roof with bevis bolts and nuts. No special light pipes is provided, as it is known that a green growth results if this deep well water is exposed to the light, particularly during warm weather.

A special feature of the reservoirs is the reinforced concrete roofing upon the Hennebique system; the roof was designed to carry the following load: Earth covering 15 in. thick, 140 lb. per sq. ft.; superload, 112 lb. per sq. ft.; own weight, 44 lb. per sq. ft.; total, 296 lb. per sq. ft.

The roof was subjected to several test loads 50 per cent in excess of the load for which it was designed, and the results were satisfactory. The Local Government Board restricted the period of loan to ten years on the reinforced concrete. The cost of roofing, beams, columns and all incidental work for the two reservoirs was £1,248 for an area of 1,100 sq. yds. between walls. The advantages of such a roof over the conventional brick arching and piers are obvious upon inspection, and the requisite strength is obtained for the purpose intended at less cost. The attitude of the Local Government Board in regard to loans for reinforced concrete work is to be regretted. If the structure is not sufficiently strong or faulty in design it should be disapproved altogether by the board. The author admits that efficient workmanship and the use of only good quality materials and careful supervision is necessary during actual construction, even for a properly designed scheme.

Statistics dealing with the administration of the waterworks undertaking are given in the accompanying table.

Wath-upon-Dearne Waterworks Undertaking. Apportionment of cost to various Capital and Revenue Departments.

Departments.	Cost for Year.	Annual Consumption.	Cost per 1,000 Gallons.	
Capital Charges:—	£ s. d.	Gallons.	d.	d.
Repayments of principal and interest, purchase of undertaking	678 15 7	113,430,000	1·436	
Boreholes, pumping station and pumping plant	679 17 4	do.	1·438	1·48
Reservoirs, sand filters, distributing mains and appurtenant works	700 15 3	do.	1·486	
Revenue Charges:				
Pumping station	773 0 9	do.	1·635	
Filters' cleaning	74 10 0	do.	·158	2·16
General maintenance, repairs, and renewals	170 2 11	do.	·367	
	£3,137 1 0	—	6·640	6·64

WATH-UPON-DEARNE SEWERAGE AND SEWAGE DISPOSAL SCHEME.*

By J. H. Drew, M.Inst.C.E.I.,
Late Engineer and Surveyor to the Urban District Council

The scheme was approved by the Local Government Board on March 30, 1914, and a loan sanctioned for £13,000 based upon the author's estimate prepared prior to the war in July, 1913. The tender of Messrs. Yorkshire Hennebique Company, Limited, for the construction of the works was accepted, and a contract entered into on November 3, 1914, the accepted tender being £13,779 3s. 9d., or about 5½ per cent in excess of the author's pre-war estimate, the increase being more than accounted for by the unforeseen circumstances and the outbreak of war in August, 1914.

The value of the work already completed is approximately £10,000, and in spite of unforeseen and unprecedented difficulties the contractors are steadily making progress. Very briefly the details of the scheme are outlined, and the data upon which it is designed are given, viz.:

Provision is made in the scheme to deal with a dry-weather flow of 300,000 gallons, or for a population of 17,650, allowing a daily average of 17 gallons per head. Six times the dry-weather flow will be treated at the works as "sewage" and "storm water," in accordance with the Local Government Board's requirements.

The sewage is "domestic," with the exception of approximately 26,000 gallons per day of brewery trade waste. There are about 2,000 privies in the district, which will gradually be converted into water-closets. All new houses are provided with water-closets.

Need of Alteration and Remodelling of Works.

The West Riding Rivers Board have been complaining from time to time, since 1896, of the unsatisfactory effluent from these works and discharges of crude sewage into the Brook Dyke; efforts have been made by the council to improve the works, and sums of money have been spent out of revenue account, but without obtaining the desired result. Since 1910 the Rivers Board have been pressing the local authority to proceed with an adequate purification scheme, but this has been delayed owing to negotiations and litigation with the brewery company, the council demanding payment for treatment of the brewery waste liquor, although this had been discharged into the public sewer for over twenty years without any contribution having been made (beyond the ordinary rates) for purification of the refuse. An amicable settlement was arrived at, and an agreement entered into on December 30, 1912, between the council and Messrs. Wentworth, Sons & Nephew, Limited, whereby the brewery company agree to pay the council at the rate of 3·07d. per 1,000 gallons for treatment of their trade waste liquor.

On completion of this agreement the council gave the author instructions to prepare the scheme now in course of construction.

Data and Method of Treatment.

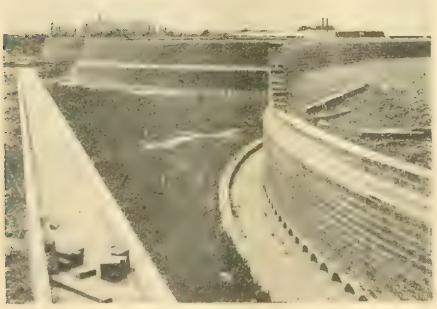
The sewage is collected upon the "partial combined" system, and is discharged to the outfall works at Low Common to the north-east of the district, at an altitude of about 64·0 ordnance datum. There are surface-water drains for road drainage in several parts of the district, but despite this considerable surface water gains access to the sewers in times of rainfall. The scheme of sewage disposal sanctioned by the Local Government Board in 1888 provided for the pumping of the whole of the sewage, but for some years past the greater part of the sewage (approximately 87 per cent) from the west, centre, and south of the district has been allowed to gravitate to the settling tanks. To enable this to be done, the 15-in. cast-iron sewer along the Brook Dyke, on approaching the disposal works, has been converted into an inverted syphon, and the sewage has been allowed to "head up" in the sewer until it overflowed at the mouth. To attain this end the sewer has been dis-

* From a paper presented at a North-Eastern District meeting of the Institution of Municipal and County Engineers held at Wath-upon-Dearne on Saturday last.

charging under a "head" of 10 ft. New property has been erected in close proximity to the line of the main sewer, and the house drainage connections from these dwellings are continuously under pressure; stoppages in the private drains are frequent, and complaints of the nuisance caused have been made to the council. This insanitary and unsatisfactory interference with the scheme originally sanctioned by the Local Government Board was evidently to avoid the cost of pumping.

The scheme now proceeding is designed so that the whole of the sewage arriving at the works must be pumped; although this is not, as a rule, desirable, it is quite unavoidable in this case, if bacterial treatment of the sewage on modern lines is adopted.

Great care has been taken in designing the scheme



Wath-upon-Dearne Sewage Works: Main Effluent Channel and Percolating Filters.
(Showing filtering media and elevated ferro-concrete channel and dosing chamber in background.)

to allow for future extensions to be easily carried into effect without interfering with or superseding the works now proposed.

There are nine storm overflows upon the existing sewerage system, but these cannot be said to be satisfactory. Some of these will probably be dispensed with on completion of the sewage disposal works, and when the 15-in. cast-iron sewer is no longer under pressure. Any storm overflows retained will be reconstructed with fixed sills to the satisfaction of the West Riding Rivers Board, and in no case will the overflow sill be set to allow discharges to come into operation until the average dry-weather flow (as ascertained by gaugings) in each particular section of sewer is exceeded by six times. Each overflow will discharge into the Brook Dyke.

A very complete series of analyses of hourly samples of sewage over a period of gaugings was made by Dr. Chaplin, city analyst, Wakefield, who also conducted a number of experiments to determine the precise character of the sewage, and the best means to be adopted for its clarification. The results of the analyses show clearly that the sewage must be regarded as a "strong" one, capable of being clarified without difficulty, and that the effluent after the separation of the solids still contains a considerable amount of oxidisable matter for the filters to deal with.

The following are the figures upon which the scheme is designed:

	Gallons.
Present dry-weather flow as recorded by gaugings	226,000
Add for growth of the district and conversion of privies into water closets	74,000
Total dry-weather flow	300,000

It is proposed to make provision to deal with the following:—

	Gallons.
Volume to be treated as sewage 300,000 x 3 ... =	900,000
" " " " storm water 300,000 x 3 =	900,000
Total	1,800,000

The whole of the sewage will enter the works through a measuring chamber, where the flow will be recorded upon a chart by a Kent's weir level discharge diagram and counter recorder. The sewage up to a volume equal to three times the dry-weather flow will pass over a fixed weir 1 ft. 6 in. in width, to the new pump well, while storm water in excess of three times the dry-weather flow will pass over a fixed weir 7 ft. 6 in. in length, through a screen to the existing storm-water pumping well, having a capacity of 28,150 gallons. The detritus tanks and screening chambers are in duplicate, and have each a capacity of 4,600 gallons. Mechanically driven cleaning apparatus is attached to the screens. From the detritus tanks the sewage passes into the sewage-pump well, having a capacity of 25,000 gallons, and is then raised to a height of 29 ft. into a channel leading to the lime-mixing plant and precipitation tanks. A mechanical lime mixer is provided, and lime and alumina ferric will be added, in the proportions which are found on analysis to give the best results. The adding of the accurate quantities of chemicals will be regulated by the flow of sewage as registered by the recording instrument.

The precipitation tank will be of the circular, continuous flow type known as the "Fieldhouse tank," and divided into two sections, each having a capacity of 115,000 gallons. The arrangement of syphon sludge pipes will permit of frequent cleansing and removal of sludge. Supernatant water can be drained from either section of the tank into the pumping well.

The sludge from the precipitation tank, storm-water pump well, and storm-water tanks will be dried upon properly constructed and underdrained filters, having an area of 933 sq. yds. and a sludge capacity of 52,500 gallons.

The clarified precipitation tank liquor will be conveyed in a 3-ft. by 1-ft. elevated ferro-concrete channel to three dosing chambers, in each of which will be fixed a 9-in. Auto-Dose valve capable of dealing with a minimum flow of 100,000 gallons and a maximum of 300,000 gallons per twenty-four hours.

The percolating filters are three in number, the internal diameter of each is 91 ft. 6 in., the floors are covered with Naylor's patent aërating tiles, and the filters enclosed with solid brick walls built in cement, 14 in. in thickness for a height of 3 ft. 6 in. at the base and then reducing to 9 in. for the remaining 4 ft. The minimum depth of filtering medium in each filter is 6 ft., an average of 6 ft. 4 in., and the contents of filtering material in each 1,543 cub. yds. Each filter will be able to deal with a volume of 300,000 gallons per day, or 195 gallons per cubic yard, which is equal to 65 gallons per cubic yard for the average dry-weather flow.

The filtering material is Siemen's acid honeycomb slag, from Sheffield steel works, to the following gauges: 2 ft. 4 in. deep, 4 in. to 5 in. gauge (bottom);

Wath-upon-Dearne Sewage Works: Sludge Filters Completed.

2 ft. deep, 2 in. to 3 in. gauge; 1 ft. deep, 1 in. to 2 in. gauge; 1 ft. deep, ¼ in. to 1 in. gauge (top).

The distributors will be of the rotary type. The filtrate will flow to a concrete channel around the circumference of the filters and pass forward to the humus tanks (in duplicate), each tank having a capacity of 13,081 gallons. The supernatant water from the humus tanks can be decanted off by floating arms and discharged to the stream or sewage pumping well. The humus is to be drained to the pump well and again passed through the precipitation tanks, as it is believed that it will aid the settlement of solids in suspension.

From the humus tanks the filtrate will pass direct to the stream.

The three existing settling tanks on the south side of the works will be converted into storm-water tanks, and these have a total capacity of 96,000 gallons. The tanks will be so arranged that when full they will act as continuous-flow tanks, and after a storm the supernatant water remaining in the tanks will be drained on to the surface of existing filters and filtered before being discharged to the stream, while the sludge deposited in the tanks will be conveyed to the sludge well and pumped to the carrier discharging into the sludge-drying filters.

The proposed new buildings will be plain, built in red brick, with stone and blue brick facings.

MECHANICAL PLANT.

It is proposed to provide a No. 4 suction-gas plant (in duplicate), each plant being suitable for supplying gas up to 57 maximum b.h.p.

The gas engines and pumps will be as follows:—

SEWAGE PUMPING IN NEW ENGINE-HOUSE.

Two 9 b.h.p. gas engines.
One 4-in. centrifugal sewage pump, duty 15,000 gallons per hour ... ... } Total 40,000 gallons per hour.
One 5-in. centrifugal sewage pump, duty 25,000 gallons per hour ... ... } Total 40,000 gallons per hour.
Against a head of 30 feet.

The duplicate of the above will be a 13·4 b.h.p. gas engine, driving a 6-in. centrifugal sewage pump, having a duty of 40,000 gallons per hour. All the pumps will be belt-driven, and can be run separately or simultaneously.

A 6·5 b.h.p. gas engine will drive the lime-mixing plant and the cleaning apparatus for the screens.

STORM-WATER PUMPING IN EXISTING ENGINE-HOUSE.

One 16 b.h.p. existing gas engine.
One 13·4 b.h.p. new gas engine.
Two 6-in. double inlet centrifugal pumps, each to deliver 45,000 gallons of storm water per hour against a total head of 23 ft.
One 3-in. single inlet centrifugal pump to deliver 10,000 gallons sludge per hour against a head of 25 ft.

The pumps are of the Gwynne centrifugal type, and the engines and suction-gas plant of Crossley's make.

Brighton Railless Traction Scheme.—The Brighton Borough Council are making application for a Provisional Order to extend for five years the period limited by the Act of 1912 for the completion of the trolley vehicle equipment.

Great Water Supply Scheme.—A water supply system is being constructed for the city of San Francisco at a cost of £8,800,000, and is to be completed during the next eight years. Water is to be brought from a distance of 181 miles, and the supply will amount to 400,000,000 gallons per day. While the capacity of the aqueduct is not as large as that of the Catskill aqueduct in New York, its length is much greater.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

WATFORD MEETING.

A meeting of the institution is to be held in the Eastern District at Watford to-morrow (Saturday).

Programme.

11.30 a.m.—Reception in the council chamber by the chairman and members of the council.
A paper by Mr. D. Waterhouse, engineer and surveyor, on "The New Water Supply and other Municipal Works at Watford," will be taken as read.
Discussion.

12.45 p.m.—Luncheon at Buck's restaurant, one minute's walk from council offices (tickets 3s. each).

2 p.m.—Walk (ten minutes) to new pumping station and softening works. These works are the completed portion of the new water scheme, which is costing about £100,000.
Members who wish to visit council's sewage pumping station, destructor and electricity works will leave the waterworks at 3.15 and walk (ten minutes) to the works.

4.30 p.m.—Assemble at "The Empress" Restaurant (one minute's walk from council offices), where tea will be provided by the kind invitation of Mr. T. R. Clark, chairman of the council, Mr. R. A. Thorpe, vice-chairman, and Mr. S. J. Ellis, chairman of the Water Committee.

Note. The fire station, with two motor fire engines, adjoins the council offices, and may be seen if desired.

P. T. Harrison, Assoc.M.Inst.C.E.,
Hon. District Secretary.
Chelmsford.

Mildred B. Robinson, B.Sc.(Lond),
Acting-Secretary.
92 Victoria-street, Westminster, S.W.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

DISTRICT FOREMAN.—October 9th.—Corporation of Halifax. 50s. per week.—Mr. Percy Saunders, Town Hall, Halifax.

SURVEYOR AND INSPECTOR.—October 10th.—Keswick Urban District Council. — Mr. J. Broatch, clerk, Keswick.

ENGINEER-IN-CHARGE.—October 14th. — Guildford Town Council. 50s. per week, with house rent and rates.—The Borough Surveyor.

INSPECTOR OF NUISANCES. — October 14th. — Sowerby Bridge Urban District Council. £100 per annum. — Mr. L. Rhodes, clerk, Commercial Bank-chambers, Halifax.

ASSISTANT SURVEYOR.—October 17th.—Wellingborough Urban District Council. £130 per annum.—Mr. R. Stevenson Henshaw, engineer and surveyor, Market-square, Wellingborough.

ELECTRICAL ENGINEER.—October 19th.—Corporation of Wigan. £400 a year.—Mr. W. H. Tyrer, town clerk, Municipal Offices.

TEMPORARY JUNIOR ASSISTANT. — Somerset County Council. £80 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY CLERK.—Somerset County Council. £110 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY DIVISIONAL SURVEYOR.—Somerset County Council. £115 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

SELBY.—October 9th.—For the erection of twenty-two cottages, for the urban district council.—Mr. B. Gray, Council Chambers, Selby.

BARKING TOWN.—October 10th.—For the repair and painting of the bascule bridge, for the urban district council.—Mr. R. A. Lay, Assoc.M.Inst.C.E., acting surveyor, Public Offices, Barking.

Engineering: Iron and Steel.

MANCHESTER. October 9th.—For the supply of a steam turbine-driven boiler-feed pump, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

LONDON.—October 12th.—For the supply of steam tubes and fittings, for H.M. Commissioners of Works. —Controller of Supplies, Office of Works, King Charles-street, Westminster, S.W.

ARGENTINE.—October 13th.—For the supply of 27,807 metric tons of light pipes and 32,164 metric tons

of heavy pipes of cast-iron, for the Ministry of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, London, E.C.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

Roads.

PADDINGTON.—October 10th. For the supply of 6,000 sq. ft. of granite setts, for the Board of Guardians.—Mr. S. J. Langford, acting clerk, 313-319 Harrow-road, W.

CARDIFF.—October 11th.—For private improvement works in several streets, for the corporation. City Engineer, City Hall.

RAWTENSTALL.—October 14th.—For the supply of manual and team labour, for the corporation.—Borough Surveyor, Town Hall.

SHEERNESS.—October 16th.—For the supply of 100 tons of 2-in. Leicester granite, 100 tons of 1½-in. granite, 100 tons of 2-in. Kentish ragstone, and 200 yds. of clean hoggin, for the urban district council.—Mr. T. F. Berry, surveyor.

TILBURY.—October 16th.—For the construction of a section of armoured concrete road, for the urban district council.—Mr. S. A. Hill-Willis, engineer and surveyor.

DUNMOW.—October 14th.—For the hire of two steam rollers, for a minimum period of sixty working days, for the rural district council.—Mr. A. E. Floyd, clerk, Dunmow.

WAKEFIELD.—October 16th. For channelling and sewering works, for the corporation.—Mr. J. P. Wakeford, city surveyor, Town Hall.

YEOVIL.—October 16th. For the supply of 2,000 tons of 2-in. and 2½-in. broken granite, 200 tons of fine granite chippings, 900 tons of 2½-in. broken limestone, and 90 tons of fine limestone chippings, for the rural district council.—Mr. L. Caplen, surveyor, East Coker, Yeovil.

ROMFORD.—October 23rd.—For the supply of about 1,650 tons of granite, for the urban district council.—The Surveyor, Council Offices, Market-place, Romford.

BEACONSFIELD.—October 25th.—For the supply of 1,000 tons of 2½-in. and 1½-in. broken granite, for the urban district council.—Mr. H. T. Smith, surveyor, Council Hall, Beaconsfield.

ARDWICK-LE-STREET.—For the laying of kerb, channel and flags (labour only), for twelve months, for the urban district council.—Mr. G. Gledhill, surveyor, Council Offices, Ardwick-le-Street, near Doncaster.

Sanitary.

BLEAN.—October 9th. For emptying cesspools and removing house refuse, for the rural district council.—Mr. R. Miles, Eddington, near Herne Bay.

BLAYDON-ON-TYNE.—October 10th.—For the removal of the contents of ashpits, for the urban district council.—Mr. R. Biggins, Council Offices.

Miscellaneous.

HALIFAX.—October 10th. For the supply of scavenger's brooms, for the corporation. Mr. D. Travis, chief sanitary inspector, Town Hall.

LEWISHAM.—October 17th.—For the supply of five dust vans, for the borough council.—Surveyor's Department, Town Hall.

CHELTENHAM.—For the supply of two tractor trailers with tipping bodies, for the corporation.—Mr. J. S. Pickering, borough engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

CHORLEY.—Accepted for the supply of paving setts, kerbs, flags, broken granite, chippings, street brooms, and rotary refills, and earthenware-pipe sewers, for the corporation.—Mr. G. H. Hopkinson, borough surveyor:—
Local Grit Setts and Kerbs.—T. C. Catterall, Anglezarke Quarries.
Natural Flags.—J. Brook & Sons, Hipperholme.
Granite and Chippings.—Penmaenmawr and Welsh Granite Company, Penmaenmawr.
Limestone and Chippings.—Horrocksford Lime Company, Clitheroe.
Concrete Flags.—Shap Granite Company, Limited, Shap; Wigan Coal and Iron Company, Wigan.
Street Brooms and Rotary Refills.—J. Phillips & Sons, Chorley.
Earthenware Pipes.—J. Crankshaw Co., Limited, Horwich.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

OCTOBER.

6.—Town Planning Institute: Address by President, 92 Victoria-street, S.W., 6.30 p.m.
6.—Municipal Waterworks Association: Annual Meeting, Metropolitan Water Board Offices, Savoy-court, London, W.C. 2 p.m.
7.—Institution of Municipal and County Engineers: Meeting at Watford.

NOVEMBER.

10.—Town Planning Institute: Mr. T. Alwyn Lloyd on "Town Planning in Wales, with Special Reference to Development of Hilly Sites."

Timber, Plywood, and Woodwork.—In next week's issue there will appear a page advertisement which will give various particulars of timber, plywood, and woodwork which Messrs. C. Jennings & Co. have for sale. The page will be found useful for reference by all who make use of such goods. The firm's head office is at Pennywell-road, Bristol, but they have branches at Leicester, Porthcawl, and stocks warehoused at Swansea, Hull, Pembroke Dock, Neyland, Newcastle, Manchester, Liverpool, and elsewhere.

APPOINTMENTS OPEN.

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Divisional Surveyor, to reside in Long Ashton. Ineligible for the Army. Applicants must be fully qualified, experienced in road making, manufacture of tar-macadam, and control of plant for same, surface tarring, &c. Able to control and supervise roadmen and keep detailed accounts, prepare estimates, &c. Salary to commence £115 per annum, with £30 per annum for upkeep of a motor cycle. Applications, stating age, experience, and accompanied by testimonials, to be sent to the undersigned.

GORDON R. FOLLAND,
Acting County Surveyor.
Wells, Somerset. (3,101)

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Junior Assistant, ineligible for the Army. Candidates must be neat draughtsmen, and should be able to make surveys and take levels. Salary £80 per annum. Applications, stating age, qualifications and experience, should be accompanied by copies of not more than three testimonials, and be sent to the undersigned, endorsed "Junior Assistant."

GORDON R. FOLLAND,
Acting County Surveyor.
Wells, Somerset. (3,104)

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Clerk, ineligible for the Army. The candidate must be fully trained in County Council work and procedure, be competent shorthand typist, able to conduct correspondence, keep all accounts, records, deal with main road estimates and draw up reports. Salary £110 per annum. Applications, stating age, experience, and accompanied by testimonials, to be sent to

GORDON R. FOLLAND,
Acting County Surveyor.
Wells, Somerset. (3,102)

WELLINGBOROUGH URBAN DISTRICT COUNCIL.

ASSISTANT SURVEYOR.

The above Council invites applications for the appointment of Assistant Surveyor, for the period of the war at a salary of £130 per annum, subject to a month's notice on either side.

Applicants must be ineligible for military service, and should have had experience in a Municipal Engineer's Office.

Applications, stating age, experience, and when able to commence duties, accompanied by copies of not more than three recent testimonials, to be delivered at my office not later than 12 noon on Tuesday, the 17th October, 1916.

R. STEVENSON HENSHAW,
Engineer and Surveyor.
Council Offices,
Market Square, Wellingborough.
October 2, 1916. (3,115)

The Surveyor

And Municipal and County Engineer.

Vol. L. OCTOBER 13, 1916. No. 1,291.

Minutes of Proceedings.

Water Supply and the Law.

Some further particulars of considerable general interest in connection with the case of the *Metropolitan Water Board* v. *Dick, Kerr & Co.*, the decision in which was noted in THE SURVEYOR a few weeks ago—were given by Mr. W. Moon, the solicitor to the board, at the recent annual meeting of the Municipal Waterworks Association. The title of Mr. Moon's paper was "Recent Cases of General Interest Affecting Water Supply," and the greater part of it was naturally concerned with a consideration of the important case just mentioned. It will be remembered that the case arose out of the action of the Ministry of Munitions in serving a notice on the defendant contractors under the Defence of the Realm Acts and Regulations informing them that it had been found necessary to restrict certain works which they were carrying out for the board and the employment of workmen thereon, and to remove the plant with a view to increasing the production of munitions elsewhere. The contractors were also required to comply with the instructions of the Ministry with regard to the plant and labour at their disposal. The procedure adopted after the service of this notice is of general interest, inasmuch as it would probably be followed substantially in other similar cases. It appears that the contractors prepared a schedule of the whole of the plant upon the land, with the prices required by them for each item. Copies of this schedule were supplied to the Ministry of Munitions, and were thence sent to all engineering firms and manufacturers of munitions throughout the country, with an intimation that if they should require any of the items they could obtain them from Messrs. Dick, Kerr & Co. at the schedule prices. In this way practically the whole of the plant, of a total value of about £100,000, was disposed of. In considering the legal effect of these proceedings on the contract between Messrs. Dick, Kerr & Co. and the board, it is important to bear in mind that in drawing up the contract the board decided to waive the usual stipulation for a guarantee or surety for its due performance, being advised that the very valuable plant required would upon its delivery on the site by the terms of the contract become the property of the board during construction. The contractors contended that, in consequence of the notice served by the Ministry of Munitions, the contract was at an end; that consequently the board had no longer any interest in the plant; and that they were entitled to retain the proceeds of the sales directed by the Ministry of Munitions. The board on the other hand took up the position that the contract was still enforceable; that, pending completion, the plant on the site was their property; and that the proceeds of its sale should at least be deposited at a bank in the joint names of the contractors and the board.

It will thus be seen that the substantial questions before the court were (1) whether the contract was still in existence as a binding contract between the parties, or whether it had been determined by the notice received by the contractors from the Ministry of Munitions; and (2) whether the plant on the site and the proceeds of the sale thereof belonged to the contractors or the board. Although a considered judgment has not yet been delivered, the learned judge who tried the case has intimated that, in his view, the contract is not abrogated, and that the plant on its arrival on the site became the limited property of the board. He further decided, however, that the contractors are not bound to repay the proceeds of the sale of the plant, on the ground that in disposing of it they were acting as agents for the Ministry of Munitions, and not in their own interests. The sequel to this decision is not without interest. The Prime Minister, in reply to a question in the House of Commons, has intimated that the general results of the decision are under consideration by the Government with a view to remedial legislation. We are inclined to agree with Mr. Moon that the only equitable basis for such legislation would be for the State to undertake to make good any loss incurred in similar circumstances by either the building owners or the contractors. We doubt, however, whether this solution will find favour with the Government owing to the wide field for claims for compensation that would thus be thrown open.

* * *

The Dentist's Bowl.

Among the many cases that have come before the courts on the question of the meaning of the expression "domestic purposes" in connection with acts relating to charges for water supply, probably none has raised quite so curious a point as one which was tried in the Westminster County Court early this year. The plaintiffs were the Metropolitan Water Board, and they

sought to recover £3, being the charge for six years, at the rate of 10s. per annum, from a dentist for water used for alleged non-domestic purposes for a revolving bowl at the side of the patient's chair. Water was, of course, also used from this tap for washing out the mouth and the usual antiseptic purposes. The surgery formed part of the defendant's house, on which the ordinary domestic water-rate was paid. The board claimed that this user of water was non-domestic under sec. 25 of their Charges Act, 1907, on the ground that it was water used for "working any machine or apparatus, and in addition or alternatively because it was water used for a trade, manufacture, or business." The learned judge delivered a written judgment to the effect that, although the mechanical contrivance perhaps came within one of the dictionary meanings of machine, it was not, in his opinion, a "machine" within the meaning of the Act, nor was the water used for the purpose of working it, the contrivance being used merely for sanitary reasons. On the second point he held that washing out the mouth was an ordinary domestic user of water, and that, although such user was ancillary to the defendant's business, which indeed could not be carried on without it, his Honour found himself unable to distinguish the case from that very far-reaching decision of the House of Lords in the case of the *Metropolitan Water Board* v. *Avery*, 1914, A.C., 118, and gave judgment for the defendant.

* * *

Interconnecting Electricity Works.

The discussions which took place at the Institution of Electrical Engineers in April last, and the circular issued to electricity supply undertakings by the Board of Trade in May, have borne good fruit. This week a Memorandum addressed to all electric supply undertakings by the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Incorporated Association of Electric Power Companies has been published. It states that the Joint Committee has arrived at the conclusion that linking-up of generating stations is important for the purpose of saving fuel, labour, and capital, besides increasing the reliability of supply, and that such linking-up can be carried out immediately in many places without fresh legislation. For this reason it is proposed to form local committees of engineers to consider the matter, and the country has been provisionally divided into suitable areas within which interconnection could profitably be adopted. Early in May such a committee was formed in the Lancashire area by local initiative, thus forestalling both the Board of Trade and the Joint Committee, and has made so much progress that in an interim report, also issued this week, full details are given regarding a comprehensive scheme that has been formulated for the districts within its scope. Four such districts are outlined, and preliminary estimates of the cost of interconnecting mains and transformers are scheduled. The committee states that the saving in coal alone, at 17s. per ton, would be £82,000 per annum, but as the export value of coal at present is from 45s. to 50s. per ton, the annual saving to the country would be nearer £240,000—nearly sufficient to cover the whole capital outlay in one year. The Treasury has intimated its willingness to provide the money for the purpose, subject to the approval of the Board of Trade and the Local Government Board to the plans, and the committee proposes that without further delay a provisional board be appointed to control the development of the scheme, pending the official appointment of a board of control under sec. 8 of the Electric Lighting Act of 1909.

The scheme so far worked out affects about twenty-six undertakings, mostly in municipal hands, having plant rated at 260,000 kw. and an annual output of 421,000,000 units, the capital expenditure on these undertakings to date amounting to over £8,000,000 sterling. The areas in question include Manchester and the neighbouring industrial centres, but do not at present extend as far as Liverpool. The importance of this great movement can hardly be over-estimated; it has already gained a momentum which promises to carry it over all difficulties, and it has several Government departments at its back. The benefits to be derived from its fruition are economy of coal, reduced capital outlay, increased capacity of the existing plant by 30 per cent (as the linked-up stations will act as stand-by to each other, instead of each providing its own spare plant), greater reliability, and lower prices to consumers. Over 60 miles of extra high-tension cable will be required to complete the interconnections, which are shown on a map of the district, and the cost will be over £280,000. In London great advantages have been secured by the partial interconnection which has been gradually carried out between the various undertakings, and there is ample scope for the adoption of the system in other important areas. The effect upon the progress of electricity supply, and upon the cost of power to manufacturers and other users, is likely to be most marked, and, in view of the coming industrial conflict with our present enemies, it is important in the national interests that all such projects should be heartily supported.

* * *

Deposits in Sewers.

The difficulties encountered by the engineer in designing sewers which shall be self-cleansing are well described in the paper, printed on another page, which was read by Mr. H. A. Cutler, the city surveyor of Belfast, at a recent meeting of the Association of Municipal Authorities of Ireland, but we think that the value of the system of supplementing the shortage of volume which occurs at times in nearly all sewers, but particularly in the case of sewers on the combined system, is not sufficiently appreciated. Assuming that the sewers can be constructed with gradients which will give a self-cleansing velocity when flowing half-full, all the difficulties due to lack of volume at times can be prevented by a properly designed system of automatic flush tanks, and if these are installed at the outset the sewers will never become so foul as to necessitate the removal of deposits by hand or by machine. In most cases flush tanks should be fixed at the heads of all lateral sewers, especially in streets not fully built upon. These tanks should be of such a capacity that the flush will have due effect—that is, cause the sewer to flow not less than half-full for the whole length down to its junction with the main sewer. This is less expensive than providing more than one flush tank on the same length of sewer. Information as to the length of sewer which can be effectively flushed by one tank can be obtained from some of the makers, who have made careful observations of the results obtained in actual practice. Similar flush tanks of suitable capacity and rate of discharge should also be fixed on the main sewer, or, as an alternative, it is possible to arrange the flush tanks at the heads of the lateral sewers in such a manner that several, even at some distance apart, shall discharge simultaneously so that their combined flushes, when they reach the main sewer, shall be sufficient to produce the desired effect in the main sewer itself. Further, in all cases, the size of the automatic syphon to be used in each tank should be determined, not by the relation of its diameter to that of the sewer, but solely by the rate of dis-

charge required to produce the desired flow in the sewer. The capacity of the tank that is, the duration of the flush will govern the length of the sewer effectively flushed. Syphons can be obtained which will discharge at any desired rate, even to the extent of putting the sewer under pressure at the top end, if this were desired, and all that is needed is the application of scientific design to the system of flushing in the same way as it is applied to the sewers themselves.

* * *

The Town Planning Institute.

In delivering his inaugural address as president of the Town Planning Institute, Mr. J. W. Cockrill, the borough surveyor of Great Yarmouth, rightly deplored the retarding influence of the war on town-planning enterprise. When it is remembered that there is virtual unanimity as to the advantages of town planning, it is not a little disappointing that in the seven years that have elapsed since the passing of the Act of 1909 only 160 schemes are being undertaken, of which only six have reached the stage of completion. It is no doubt true that the war is largely responsible for the present unsatisfactory state of affairs, but it might at least have been expected that a much larger number of local authorities would have undertaken the work of preparing schemes with a view to their execution after the conclusion of peace. Mr. Cockrill was mainly concerned to convince the speculative builder that town planning is for him a good business proposition, and we agree that if it were only possible to bring this conviction home to those most nearly concerned, half the battle for better housing conditions would be won. In this connection Mr. Charles Booth once wrote: "I wish I could rouse in the minds of speculative builders a sense of the money value that lies in individuality, with its power of attracting the eye, rooting the affections and arousing pride in house and home. Then would they seek to use, in place of sedulously destroying, every natural feature of beauty, and take thought of others; a slightly greater width of garden on the sunny side, whether front or back, may make all the difference; a single tree left standing can glorify a whole street. Fresh painting and papering within is not the highest ideal—its charm passes; the other gathers force as the years go by."

Dealing with building works after the war, Mr. Cockrill pointed out the difficulties which are bound to arise owing to the enormously increased cost of labour and materials. As we have said on former occasions, it appears that the situation will have to be met by some form of State aid. At all events, we agree with Mr. Cockrill that it is to be hoped that no hard-and-fast standardised type of reinforced-concrete building will be universally adopted without reference to æsthetic considerations.

* * *

Air Raids and Street Paving.

We have received from a correspondent a communication which contains a warning against the possibilities of serious street fires being caused by the dropping of incendiary bombs from airships on to wood-paved roads. There can be no doubt that the materials used in soft-wood paving are in themselves highly inflammable, the blocks being impregnated with creosote oil and embedded in pitch and tar, but so far as we are aware the danger to which our correspondent refers has not yet materialised. This immunity is probably due to three main causes: First, the film of dirt which usually covers the upper surface of the blocks; second, the particles of crushed stone that are rolled into the surface fibres; and third, the cement filling which is run into the joints above the pitch. Danger from the cause indicated would appear to be even more remote in the case of hard-wood blocks, which are not only less inflammable in themselves, but are invariably laid without being creosoted. Our correspondent, while not adopting an alarmist attitude, suggests certain simple precautionary measures. In the first place, he thinks that it is unwise in these days to stack large quantities of creosoted blocks in the streets, or, when old blocks are being lifted, to leave them in large heaps for any length of time. He further suggests that stands for taxi-cabs and other places specially liable to become saturated with petrol and oil dropped from motor vehicles should be paved with granite, and lastly, that sand for extinguishing fires should be readily accessible at frequent intervals near wood-paved roads. Our readers may think that the precautions are more alarming than the alleged danger. Be this as it may, it would be interesting to hear their views on the question raised by our correspondent.

* * *

A Living Wage?

In the last few months women have invaded many spheres of labour which had in pre-war times been monopolised entirely by men, and, having regard to the large number of men employed on outdoor work by local authorities, it is perhaps surprising that more women have not undertaken this class of work than is in fact the case. The woman tram conductor or tram driver is now a familiar figure, but we have not yet become accustomed to the "road-woman" or "sewer-woman." In some districts, however, women have been engaged on the roads, and here, as in many other novel occupations, they have been more successful than might have been expected. Indeed, the unfamiliar work which women have undertaken as a result of war conditions has as a rule been done with remarkable thoroughness. For this reason we are, or ought to be, specially careful that the new women-workers are treated with scrupulous fairness. An apparent example of the way not to do it is afforded by the Sudbury Town Council. In that district several women are engaged on the roads, and although it is admitted that they have worked well, it appears that they are paid at the miserable rate of 3d. an hour. This means that at the end of an eight-hour day they receive the munificent reward of 2s.—and this with food at war prices. Surely it is "up to" Sudbury to do better than this!

* * *

The Rebuilding of Dublin.

It is satisfactory to find from the *Freeman's Journal* that, as a result of negotiations which have been in progress during the past fortnight, an agreement has practically been reached between the Corporation of Dublin and the Fire and Property Losses Association with respect to the provisions of the Dublin Reconstruction Bill. All sorts of rumours have been in the air recently as to unexpected difficulties having arisen with respect to the prospects of the Bill being passed into law, and as usual allegations that sinister influences were at work to wreck the prospective settlement were only too plentiful. All these excitations would seem to amount to is that certain matters of detail have still to be arranged, but it is not expected that these will present any serious obstacles in the way of a settlement. Should this expectation be fulfilled—and there is the best reason for believing it will be—the Reconstruction Bill will proceed as an agreed measure so far as the representatives of the various Dublin interests are concerned. Unless, therefore, some fresh obstacle is interposed to the scheme as agreed upon the prospect of an early start being made with the work of reconstruction appears to be quite satisfactory.

Prevention and Removal of Deposits from, and Repairs of, Sewers.*

By HENRY A. CUTLER, M.INST.C.E., City Surveyor of Belfast.

The subject of this paper is one which at some time or other engrosses the minds of all engineers and surveyors to municipal authorities, and there are some districts where, owing to physical conditions, errors in design or other causes, the subject requires very frequent attention.

All who are accustomed to the design of sewers endeavour to obtain such gradients as will give self-cleansing velocities when the sewers are flowing full—that is, velocities of about 3 ft. per second for small sewers, decreasing as the sewers increase in size to a minimum of about 2 ft. per second, and as circular sewers have theoretically the same velocity when flowing half full as when flowing full, they will remain self-cleansing under all conditions of flow between those limits.

When the normal condition of flow is small compared with the size of a sewer (although when flowing half full it may be self-cleansing), deposits will occur. A small decrease in velocity will allow the particles which are largest and of highest specific gravity to be deposited, and a further decrease the smaller and lighter particles.

As there are many conditions to be satisfied when determining the sizes and gradients of sewers, it is not always possible to make them self-cleansing under all conditions, and, further, we do not always give the normal flow conditions sufficient consideration.

VARIATIONS OF FLOW.

To form some idea of the possible variations of flow, let us consider the conditions in a densely populated area, where there may be as many as 250 persons to the acre, a sewage flow of 30 gallons per head per day, and a rate of rainfall flowing off during the heaviest storms of ·66 inch per hour. The average rate of sewage flow from such an area would be 50 cub. ft. per hour, and the minimum about 25 cub. ft. per hour, and the maximum rate of rainfall flowing off would be 2,420 cub. ft. per hour, or about 100 times greater than the minimum sewage flow. Even taking sewers the maximum discharging capacity of which is only six times the average flow, we get a variation of 12 to 1 between the maximum and minimum, and as the Local Government Board requires that sewers should be of sufficient size to convey sewage to the outfall works for treatment at the rate of at least six times the average sewage flow, it will be seen that, without having to provide for heavy rainfall, the conditions are sufficiently difficult to deal with.

Taking the variation of 12 to 1 as the least that must be contemplated with combined drainage, and assuming that such variation is taking place in a circular sewer which is running full when discharging the maximum quantity, the depth of flow when the minimum quantity is being discharged will only be ·19 of the diameter, and the velocity ·59 of the velocity when flowing full or half full.

Sewers of large capacity are usually made oval or egg-shaped, with a view to increasing the velocity where the flow is comparatively small, and applying the foregoing variation of flow to an egg-shaped sewer the minimum depth of flow would be ·21 of the vertical diameter of the sewer, and the velocity ·64 of the velocity when flowing full.

From these figures it will be seen that with a variation of flow of 12 to 1, gradients of sewers, so that they may be self-cleansing at all times, should be such that the velocities when running full would be from about 3½ ft. per second for large sewers to about 5 ft. per second for small sewers.

As in fixing the sizes of the sewers one has to provide for an increase of population over a period of about thirty years, the problem gets the more difficult, and the original minimum flow, compared with the capacity of the sewer, may be such that it is absolutely impossible to prevent deposit.

Fortunately, the proportion of solids reaching sewers is much smaller during the period of minimum flow than at other times, and as they usually consist chiefly of the smaller and lighter particles, velocities less than what are usually considered self-cleansing will remove them.

It is also often found that deposits which accumulate in sewers in dry periods owing to sluggishness of sewage flow will be washed out in times of heavy rainfall, but such accumulations may become offensive in warm and dry weather and require to be periodically removed.

Although in most cases in designing new sewers it is possible to make them self-cleansing, there are cases where the necessary gradient is impossible, especially where gradients are governed by the levels of existing sewers.

It is also sometimes found that sewers which would have a self-cleansing gradient for ordinary sewage become sewers of deposit owing to the character of the liquid discharged into them.

REMOVAL OF DEPOSITS.

Having considered the difficulties and, under some conditions, the impossibility of preventing deposits in sewers, the question of how deposits are to be removed when they occur naturally arises. The most common, and usually most satisfactory, method is by flushing, but to be effective it must be carried out systematically and periodically.

Flushing may be carried out by specially constructed tanks with a syphonic discharge; by discharges from tank carts, or by damming the sewage flow until a large quantity of sewage is impounded above the length to be cleaned and suddenly releasing it.

For flushing branch sewers or the upper ends of main sewers the permanent flushing tank or tank carts are the only possible means; but for main sewers, especially large ones, flushing by damming up the flow is usually the cheapest and most effective method.

Cases where deposits cannot be removed by flushing alone are not uncommon, as most officers who have had charge of sewers will have found, and the removal of such deposits is always expensive and sometimes impossible except by breaking into the sewer at frequent intervals.

The most usual method of removing such deposits is by a chain and "badger," which is moved backwards and forwards in the sewer to rake up the deposit and keep it agitated so that it will be carried down by the flow in the sewer.

Badgers are made according to fancy, the most usual being a bunch of heavy chain fixed to the hauling chain, but sometimes some form of bucket or disc is used.

The hauling chain is got through the length of sewer to be cleaned by first floating a line through or pushing it through with sewer rods.

Badgers are useful where there is sufficient flow to carry off the deposit when agitated, and some form of bucket or disc may be useful if there is not much deposit in the sewer, but it cannot be pulled through against any weight of silt.

Difficulties have recently been experienced in Belfast in cleansing a sewer where the gradient was very flat and the deposit of a plastic nature due to the presence of tarry matter. After the usual methods of removing the silt had been resorted to without success, openings had to be made about every 20 ft., the crown of the sewer removed, and the deposit dug out. As these operations were costly, and caused permanent damage to the sewer, the author considered the matter of sufficient importance to warrant the spending of time in trying to devise special apparatus to deal with the deposit without breaking into the sewer.

After designing several forms of scraper, models were made and tried in a glass tube partly filled with sand, and ultimately a full-sized scraper was made in accordance with the model, which proved most successful. The actual scraper did its work well, but owing to open joints in the sewer in which it was tried, it was found necessary to make some improvements to prevent the scraper sticking in the open joints.

Since the improvements were made, sewers of

* Paper read at the recent annual conference of the Association of Municipal Authorities of Ireland.

lengths up to 100 yds. between manholes have been successfully cleaned, even where more than half full of silt.

The scraper does not enter the sewer at the upper end of the section to be cleaned, but at the lower end, from which it is pulled by a rope previously passed through the sewer. The act of pulling in causing it to lie flat and skate over the deposit, when the scraper has been pulled in a few feet (according to the quantity of deposit in the sewer), it is withdrawn by a rope attached to its after end, the pulling back causing it to turn up and bring the deposit back with it.

The operation proceeds a length or so at a time, the scraper being pulled farther into the sewer each time it is introduced, until ultimately the whole of the deposit in the section has been removed.

After each withdrawal of the scraper the silt is filled into buckets and lifted to the surface, and the quantity of deposit against which the scraper has to be pulled is limited by the extra distance the scraper is drawn in after each operation.

REPAIRS

Where sewers are laid in running sand, and any open joints occur, sand will find its way into the sewers with the subsoil water, and if the velocity of the flow is insufficient deposits will accumulate.

The author has had considerable of this nature, and by means of stoppit dams has been able to undertake making good joints and execute other repairs where the sewers have been over 2 ft. in diameter without cutting from the surface.

When the sewer is 2 ft. 6 in. in dia. clay stanks are usually constructed inside the sewer at each end of the portion under repair, and a trough put in between the stanks so as to keep the sewage from the bottom and walls of the sewer while the repairs are being made. As the size of the manhole limits the length of the trough which can be put inside the sewer short lengths are usually joined together in position.

As the space occupied by an ordinary trough prohibited its use in the small sewers the author was repairing a length of canvas about 5 yds. long and 1 yd. wide was laid on the invert of the sewer and half way up the sides; the ends of the canvas were secured by iron hoops expanded inside the sewer over the canvas, and similar iron hoops were used over the canvas on each side of each joint about 4 in. apart.

The iron hoops were screwed tight enough so as to make a cushion against the canvas to prevent leakage past the hoops.

When the canvas trough was ready cement grout was run into the joints at the back of the canvas between the hoops, and the canvas left in till the joints had set.

The arrangement referred to enabled the bottom half of each joint to be perfectly made without any obstruction to the flow in the sewer, and the top half, where the joints were not too wide, was pointed in the ordinary way.

Road Surveyors' Petrol Allowances.—It was reported at the last meeting of the council of the Institution of Municipal and County Engineers that Mr. J. S. Pickering, borough engineer of Cheltenham, had written with regard to the question of the limited supply of petrol to road surveyors, and it was resolved, on the recommendation of the General Purposes Committee, that Mr. Pickering should be requested to write to the Road Board on the matter, and that the secretary should also communicate with the board asking for sympathetic consideration of individual applications in view of their special circumstances.

The Decimal System.—The Decimal Association are asking for the support of local authorities to the following proposition: "That, in the opinion of this council, it is of supreme national importance that prompt steps be taken to secure the maximum of trade with foreign countries when the war is over. To this end the council considers it not only desirable, but absolutely essential, to adopt the decimal system of coinage, weights and measures throughout the British Isles, and thus enable our manufacturers and merchants to compete more easily and successfully with rival nations having that system already in use, and the council requests the local Chamber of Commerce to take the matter into their serious consideration and do all in their power to help forward this important and necessary reform."

CLINKER-MEXPHALTE WORK AT WOLVERHAMPTON.

It will be remembered that the Clinker-Mexphalte exhibits aroused great interest among engineers visiting the Stand of Highways Construction, Limited, at the Road Conference and Exhibition in 1915, and the work carried out under this process since that time has fully justified the claims then made.

Engineers will now be interested to learn that Mr. G. Green, M.INST.C.E., borough engineer and surveyor of Wolverhampton, has recently been laying bituminous roads composed of Mexphalte and crushed clinker from the local destructor.

Highways Construction, Limited, who are licensees of this process (which has been patented by one of the most practical and experienced of our road engineers—namely, Mr. E. J. Lovegrove borough engineer of Hornsey), have in this instance acted as advisers to the corporation of Wolverhampton, who are executing the work under sub-licence from them, Highways Construction, Limited, setting the specification, providing laboratorial check on the material as laid, together with skilled supervision both at the manufacturing depot and on the roads. The corporation provide the clinker from their destructor, being responsible also for all labour, fuel, carting and rolling, and the preparation of the existing road surface, while Highways Construction, Limited, supply the Mexphalte (bitumen) for making the matrix and the necessary grinding and manufacturing plant.

Two roads have already been laid with this process and are wearing well, and a third Dudley-road is now in course of construction.

On the 27th ult., at the invitation of Highways Construction, Limited, these roads were inspected by the following engineers and surveyors—namely, Mr. H. E. Stilgoe (Birmingham), accompanied by his chairman, Mr. Talbot, Mr. J. E. Swindlehurst (Coventry), Mr. A. Burton (Stoke-on-Trent), Mr. W. A. H. Clarry, with Mr. Alderman Glover (Sutton Coldfield), Mr. P. A. Benn (Lichfield), Mr. Wm. Plant (Stafford), Mr. F. H. Gibbons (deputy surveyor, Dudley), representing Mr. John Gamage, borough engineer of Dudley, who unfortunately was unable to attend owing to an accident.

Mr. Green, Mr. F. G. Beaumont, the deputy surveyor, and Mr. H. W. Lovatt, of Highways Construction, Limited, explained the process to the visitors.

Previous to inspecting the roads the party visited the manufacturing depot installed at the Wolverhampton destructor works. Clinker, which is taken direct from the destructor (after as much metal as possible has been removed by hand), is crushed in a large self-emptying mortar grinding mill and elevated to a screen. The product is collected in twin bins—the fine for use in the carpet or top coat, and the coarse (that is to say, all not passing the screen) for bottom or binder course. It is then conveyed to open hearth driers, heated to the necessary temperature and elevated to the mixer, where the required amount of Mexphalte is added. After the ground clinker and the Mexphalte have been thoroughly mixed, the mixture is self-discharged into carts standing beneath the mixer, conveyed to the road, spread and rolled.

On the conclusion of the inspection of the manufacturing installation the visitors were conducted over the roads which have been completed or are in course of completion. These are all subject to heavy traffic, and therefore the two-coat system of construction has been employed. It was explained that prior to laying the Clinker-Mexphalte the existing macadam is scarified to the required depth and swept perfectly clean; the bottom or binder course, about 2 in. thick, is then laid and rolled, and after this has become cool the carpet or top coat, 1 in. thick, is spread and consolidated, the steam roller being brought on to the material as soon as it is laid, in order to obtain the maximum amount of consolidation possible. The visiting engineers particularly noted that this results in a very dense and even surface, closely resembling rock asphalt in appearance.

The roads surfaced up to date, and which were inspected, are as follows:—

(1) Union-street.—Area, 330 yds. super.; width between kerbs, 20 ft.; existing foundation, water-bound macadam, subject to heavy lorry traffic

between railway station and the business centre of the town.

(2) Market-street.—Area, 1,000 yds super.; width between kerbs, 20 ft.; existing foundation, old bituminous macadam; heavy through traffic; also a large brewery situated in this street, which produces heavy local traffic.

(3) Dudley-road.—Area, 4,500 yds. super.; existing foundation, ordinary water-bound macadam. The area being covered is on both sides of a double tramway track; in places is somewhat narrow in width. Traffic heavy, subject to traction engines, Foden wagons, heavy motor lorries, &c.

It is interesting to note that Mr. Green is about to commence using the above form of construction for roads carrying lighter traffic, in which case a carpet or single coat, 1½ in. thick, will be laid directly on the existing macadam, the necessary crossfall—where the existing crown of the road is low—being obtained by laying binder course material. The specification of the single coat work is the same as for the carpet or wearing surface employed in the two-coat method.

All the engineers who visited Wolverhampton have destructors of their own, and freely expressed their satisfaction with the results attained, which fully demonstrate that Mexphalte, with its well-known qualities, is particularly adaptable to use with destructor refuse, and that the process enables engineers to find an outlet for the disposal of their clinker, which is ofttimes a troublesome and expensive matter, and at the same time enables them to provide a road surface which meets the requirements of modern traffic.

We do not doubt but that many engineers will be following Mr. Green's example in the near future, especially in view of the difficulties which are now being met with in the maintaining of road surfaces due to abnormal traffic arising from war conditions. This system of road surfacing should certainly be borne in mind in connection with road work schemes to be carried out after the war, as it is anticipated that motor traffic on the roads will considerably increase in years to come, and Mexphalte mixed with an aggregate of clinker, stone or sand, appears to be particularly suitable for this class of traffic.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάνθ' ὁρᾷ
(One man does not see everything.)
—Euripides.

THE METRIC SYSTEM.

To the Editor of The Surveyor.

Sir,—

"No better opportunity than the present may occur for a century for carrying out the reform of our troublesome and hopelessly unpractical weights and measures by the adoption of the Metric system."—*The Chamber of Commerce Journal*, October, 1916, p. 248.

Early in this year the writer published a book, "British Trade and the Metric System," which revolutionises the accepted theories on weights and measures. The claims made may be briefly stated as follow:—

(1) The British system is a mixture of three distinct scales—namely, the decimal, the fractional, and the duodecimal. The confusion which has arisen in the system is due to mixing up three different sets of weights and measures. When re-separated and re-completed the three form a harmonious system without parallel or equal anywhere at the present day.

(2) Decimals have no theoretical advantage over fractions, while in practice fractions have many advantages over decimals, the most important being simplicity in calculation and fitness for employment in mental arithmetic. The British money table helps the poor as well as the rich. The rich man's coin is a shilling; the poor man's a farthing. To the rich the table offers a decimal scale; to the poor a fractional scale.

(3) See the New York *Engineering Record*, June 10, 1911, on "The Curse of the Nickel," one result of a purely decimal currency. The American decimal currency is a currency for millionaires, who deal in dollars and care very little for its sub-divisions, except as a means for calculation of profits and losses, to make more dollars.

(4) The British decimal system (B.D.S.) has for its base the British meter of 5 links, or 39·6 in. This meter (*vide* "Encyclopædia Britannica," vol. xxiv., p. 484) is the direct descendant of the ancient Belgic yard, once in common use throughout Europe (see the writer's letters to *Builder and Building News*, issues ranging from August 2 to September 22, 1916). The British metric ton, the cube of 39·6 in. of water at freezing point, is our existing British ton of 2,240 lb. These two units may be contrasted with the French metre of 39·37 in. and *tonne* of 2204·62 lb.

(5) Further, the much-maligned, troublesome, and hopelessly impractical British system contains a duodecimal system, based on the Indian yard of 33 in., which is as wonderful and complete as either the B.D.S. or the Metric system.

(6) The British triple system is constructed by dividing Gunter's chain (of 20 Belgic yards) into 10, 11, and 12 parts, the halves of which are respectively the Belgic yard or British meter, the British yard, and the Indian yard, or gudge. Compare the French metre and the French 20-metre chain. It will be seen at once that the metre of 39·37 in. is an approximative modern substitute for the ancient Belgic yard and "Gunter's chain." The much-abused rod, pole, or perch is 5 Belgic yards, the quarter of "Gunter's chain." The abuse is apparently founded on the fact that 5 "Belgic" yards are equal in length to 5½ "British" yards. A rood is 1,000 square British meters; an acre is 4,000 square meters; and a rod of brickwork is in area 25 square meters. *All these units actually exist, and are not invented by me.*

(7) Given Fair Play and Fair Trade, we do not need to adopt the Metric System in the Empire for any but special purposes.

(8) The B.D.S. places the key of Continental knowledge in the hands of all our people. Anybody can take a Metric book or drawing and read off all dimensions, &c., at once as B.D.S. units with a certain known error which he can allow for. An architect or an engineer can design anything he pleases in B.D.S. units, employing either French or British constants and formulæ, and the result will be equally correct and in proportion when read off either in the B.D.S. or in the Metric system.

(9) The Belgic yard is a better and more international measure than the French metre. The scientific basis is this: The inch ought to be the 1-500,000,000th part of earth's polar axis. Gunter's chain ought to be 792 in. (divisible by 2, 3, 4, 6, 8, 9, 11, and 12, without remainder). The Belgic yard or meter ought to be 1 1-10th of a common yard, or 39·6 in., the common yard ought to be 36 in., and the duodecimal yard ought to be 33 in. This Triple system, or tripod, is to be found in the great Pyramid, and is therefore more than 4,000 years old. The Belgic yard now in use is 39·6 in., and is the 1,000th part too short; it ought to be 39·64 in. In the third century it was actually 39·66 in. The difference, compared with the difference in the French metre, is so small as to be negligible.

(10) Our British Weights and Measures are More Accurate Earth Measures, and More International, by reason of Correctness, Origin, and Antiquity, than any other in the World to-day. They are based on earth's polar axis, about which the whole globe revolves, and on a similitude of earth's girdle, the Equator, the dividing line of the two hemispheres. A measure based on a meridian through any capital city is national, and can never be international.

(11) Everything which can be said in favour of the Metric system is equally applicable to the B.D.S.

The writer regrets he cannot agree with any Metric advocate, since the British system is sounder, better, and more scientific. It is waste of time airing any more stale theories and employing the old threadbare arguments, *vide* your issue dated October 6th, pp. 300 to 302. The new "discovery" (see my book and other references given above) has opened a new field, and has made the Metric system itself, so far as the length of the metre is concerned, obsolete and out-of-date. A metre other than 39·6 in. in length, whatever the length of the inch may be, is an abomination. We must either reduce all our units to the 39·37 in. standard or else we must induce the Allies to accept the ancient 39·6 in. standard, and leave the short, inaccurate metre to the Huns.

At the present time the Germans have destroyed the workshops of France, Russia (Poland), and Belgium, so that a change over by the Allies to the B.D.S. would seem to be not only good business, but sound, anti-German policy. It would merely be a reversion to an accurate meter, once in common use, and still in existence here.—Yours, &c.,

E. A. W. Phillips, M.Inst.C.E.

Hove.

October 7, 1916.

Institution of Municipal and County Engineers.

MEETING AT WATFORD.

A meeting of the Institution of Municipal and County Engineers was held at Watford, Herts, on Saturday last, when an entirely profitable time was spent in discussing a paper in which Mr. David Waterhouse, the surveyor to the urban district council, furnished an account of the various works which have engaged or are engaging his attention. At present Mr. Waterhouse's activities are mainly centred on the carrying out of a scheme of water supply which the rapid development of the town has necessitated, and to-day the greater part of his paper was devoted to a description of this undertaking, the completed portions of which were visited by the members of the institution in the course of the afternoon. Mr. J. S. Brodie (Blackpool), the president, occupied the chair during the proceedings—which opened at the council offices—and there were present Messrs. H. T. Wakelam (Middlesex), A. E. Collins (Norwich), Thomas R. Clark (chairman, Watford Urban District Council), B. A. Thorpe (vice-chairman, Watford Urban District Council), G. W. Longley (Watford), W. Nisbet Blair (St. Pancras), Edward Willis (Chiswick), Henry A. Cutler (Belfast), Percival T. Harrison (Chelmsford), hon. district secretary, Fred. T. Negus (St. Albans), W. H. Duckworth (Watford), William W. Newman (Watford), William Banks (Rochester), John L. Redfern (Gillingham), E. Young Harrison (Guildford), C. Chambers Smith (London), Percy Bennett (Harrow), Harold Collins (Colchester), P. G. Killick (Finsbury), J. E. Hattersley (Buckingham), W. R. Lock (Hemel Hempstead), Ernest E. Ryder (Bushey), James A. Webb (Hendon Rural District Council), R. C. Newport (Kingsbury Urban District Council), H. Tingle (Westminster), T. Bowes (Herts County Council), J. S. Killick (Herts), T. W. A. Hayward (Battersea), G. Duckels (Watford), O. E. Winter (Hampstead), H. Hodges, Nuneaton (visitor), R. C. Moon (Nuneaton), W. H. Jarvis (Erith), W. Gomersall (Erith), L. P. Marshall (Ringwood), C. Carkeet Jones (Westminster), James Dewhirst (Chelmsford), R. J. Jenkins (Portsmouth), G. Smith (Eton), Herbert N. Hodges (Berkhamsted), R. Stevenson Henshaw (Wellingborough), W. E. Hall, Wellingborough (visitor), T. J. Rushbrooke (High Wycombe), Frank Roberts (Worthing), W. Goodrich (Watford), E. Pollard (Leighton Buzzard), E. J. Saunders (Leighton Buzzard), G. Cartell (Hemel Hempstead), Edward D. Robertson (Hemel Hempstead), Lewis F. Dunbar (Hemel Hempstead), Wm. O. Ord (Croydon), G. Atkinson (Croydon), J. H. Brierley (Richmond), and Mrs. Robinson (acting secretary).

Mr. T. R. CLARK, chairman of the district council, in welcoming the members, commented on the debt which the country owed to the municipal engineering profession. The tremendous improvement in the health of the public, and the amenities of our towns during the last fifty years could not have come about if there had not been at the service of the ratepayers throughout the country an exceedingly able and public-spirited body of municipal engineers. It was a well-known fact that municipal engineering science was at the present day second to none. He could not therefore regard it in any other light than a great honour to Watford that they should have determined to pay them a visit. The growth of Watford in recent years had been enormously rapid, and its municipal expansion had been equally extraordinary. Within recent years large public parks and recreation grounds had been provided; an electricity undertaking had been established, the operations of which now covered a very large area of the surrounding country, and which was now thoroughly successful financially; municipal dwellings had been set up; many acres of allotments had been provided; an excellent system of sewerage and sewage disposal had been put into force; open-air swimming baths had been provided, together with a number of other matters, and last, but not least, a splendid system of water supply had come into being, the extension of which was now being rapidly proceeded with. The only drawback to their local water, if it could be called a drawback, was that it was somewhat hard; but they would see a most up-to-date and, they believed, efficient softening plant, which would go a very great way to eliminate this objection. In spite of all these improvements, he was pleased to say that the general district rate had for some years shown a consistent decline. He thought they would agree that this was a record of which any town might be proud.

Mr. R. A. Thorpe, vice-chairman of the district council, Mr. S. J. Ellis, chairman of the Water Committee, Councillor Goodrich, and Councillor Longley, chairman of the Finance Committee, also joined in the welcome to the institution.

The meeting afterwards proceeded to the consideration of Mr. Waterhouse's paper, extracts from which are appended.

NEW WATER SUPPLY AND OTHER MUNICIPAL WORKS AT WATFORD.

BY DAVID WATERHOUSE,
Engineer and Surveyor to the Urban District Council.

Watford, said Mr. Waterhouse, although not the county town of Hertfordshire, has the largest population of all towns in the county—namely, 45,000—an increase since 1901 of nearly 16,000.

It is still an urban district, and has now an area of 2,061 acres, which will probably be increased by an extension of 1,566 acres after the war. About one-fifth of the district is the property of the town, and includes the sewage farms, allotments, park, recreation grounds, and other sites. The district varies in level from about 170 ft. to 307 ft. above Ordnance Datum, and the soil is chiefly gravel overlying chalk several hundred feet in thickness. It is situated in the south-west corner of Hertfordshire, about 15 miles from London.

The district is partly residential and partly manufacturing, its rateable value (poor rate) is £218,282, and its assessable value (district rate) is £196,828.

NEW WATER SUPPLY.

Mr. Waterhouse went on to describe in considerable detail the new water supply works which the rapid growth of the town has rendered necessary. The scheme, which provides for a still further substantial increase of population, is based on a supply of 1,500,000 gallons in ten hours, and is estimated to cost £114,000. We propose to describe the works more fully in our next issue; for the present it may be stated that the scheme embodies a new deep well, pumping station and softening works, a service reservoir to hold 2,000,000 gallons, and the necessary pumping and delivery mains, which will be connected to the existing distribution system.

SEWERAGE AND SEWAGE DISPOSAL.

The drainage of Watford is on the partially "separate" system; the storm water is conveyed through separate sewers of diameter from 30 in. to 9 in. to the natural watercourses, and the sewage through gravitation stoneware sewers, of diameters varying from 27 in. to 9 in., to the ejector stations at Cassio Bridge and Willow-lane, and to the pumping, ejector and air-compressing station at Cardiff-road. Generally speaking, part of the roof water from houses passes into the surface-water sewers, being conducted across the public paths to road channels, and part from the back roofs into the soil sewers.

From Cassio Bridge and Willow-lane stations the sewage is lifted direct by the ejectors to the highest part of the sewage farms, and at the Cardiff-road station two ejectors discharge the sewage, together with that from an 18-in. outfall, through screens in a receiving tank into the old precipitation tanks, which are now used as storage tanks. From these tanks it is pumped through a 12-in. rising main to the highest part of the farms, where the whole is distributed for treatment.

An overflow is provided at the storage tanks for delivering the storm water on to about 5 acres of osier beds; this overflow only comes into action on the occasion of heavy storms.

The sludge retained in the receiving tank is disposed of in a very simple and effective manner. Twice every week a valve is closed on the outlet of the low-level ejectors, and the sludge diluted and passed back through a sludge main to these ejectors. From here it is lifted through a by-pass to the 27-in.

sewer, which discharges into the high-level ejectors. On its discharge into the sewer the sludge is diluted with a large volume of sewage, with which it finally passes on to the farm, causing no trouble in disposal.

SEWAGE FARMS.

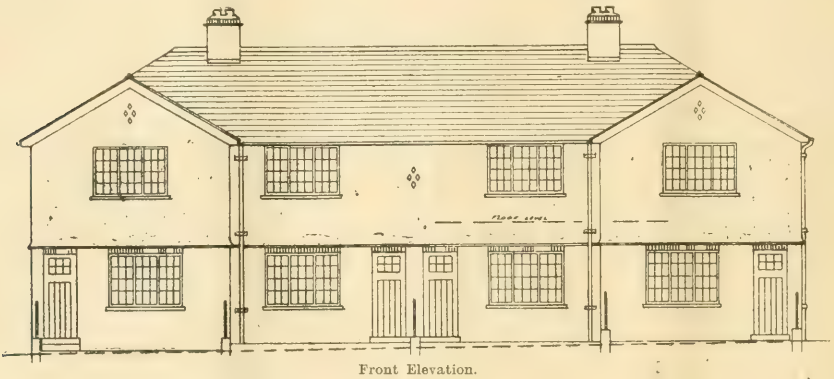
The whole of the sewage, amounting to an average of 1,450,000 gallons daily, is discharged by the ejectors and Worthington pumps to the highest parts of the farms, and is conveyed in underground carriers for distribution on to any part of the farms, to undergo treatment by broad irrigation.

The farms, which are two in number, are about 200 yds. apart, and have a total area of 226 acres, the Holywell farm covering 106 acres, and the Cassio Bridge farm 120 acres. Their situation is admirable, and the land, which has a gravel subsoil, overlying chalk, is well suited for the purpose of a broad irrigation treatment of sewage, the higher portions of the farms having a gravel bed of over

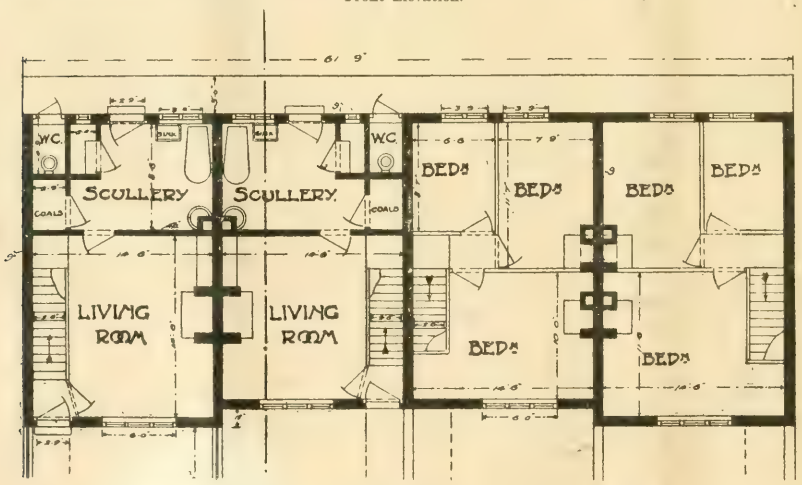
from a fortnight in summer to four to six weeks in winter, the sewage is turned on to another portion of similar area; the first portion in the meantime undergoing a rest is, when dry, ploughed over and prepared for retreatment, the whole of the area being treated in like manner. The interval of rest which each 40 acres of treated land undergoes is of from two to three years' duration, during which time it is cropped.

It will be of interest to add that we are troubled with no sewage effluent whatever, and the quality of the land and method of treatment is such that sewage sickness is unknown.

The produce from the farms consists of the following: From the "treated" land—mangolds, oats, rye-grass, clover and tares; and from the "non-treated" land—turnips, maize, oats, mangolds, rye-grass, clover and green-stuffs. Other portions of the farms are occupied by allotments, cart sheds and stables,



Front Elevation.



Ground Floor. First Floor.

Watford Housing Scheme: Block of Four Dwellings.

20 ft. in thickness. A total area of 140 acres is available for treatment, the remaining area, consisting of pasture and arable land, is cropped as ordinary farm land.

On the average, about 40 acres of land are required for disposal of the sewage; this area is kept fallow, and is treated with sewage for one season. The cropping is so arranged that, upon one area of 40 acres having performed its work of purification, another similar area is available; by this system no sewage is placed on growing crops.

The method of treatment which each 40 acres undergoes is as follows:—

The sewage conveyed through the underground carriers to that part of the farm which it is desired to treat is distributed through plough-cut furrows or carriers, over an area of about 4 acres. After this portion has undergone treatment for a period varying

at which accommodation is provided for thirty-six horses, which do the team labour of the town and farms.

With regard to the cost of working the farms, it is interesting to note that, taking one year with another, and after being charged with rent, rates and taxes, their upkeep costs nothing; the income covers the expenditure with a small margin on the right side. At the same time, the primary reason for a sewage farm, which is the satisfactory disposal of sewage, and not the making of profits, is always the first consideration.

DESTRUCTOR WORKS.

The destructor, which was erected in 1903, is of Meldrum's front-feed regenerative type, known as a four-grate destructor, and having a total grate area of 100 sq. ft.; immediately behind the grate is a combustion chamber, which not only serves its

primary purpose is securing a perfect diffusion of the gases at a high temperature, but also traps nearly 60 per cent. of the dust. For the rapid and effective cremation of large masses this combustion chamber has been most valuable.

From the combustion chamber the hot gases, at a temperature of about 2,000 deg. Fahr., pass through and around a Lancashire boiler, 30 ft. long and 8 ft. in diameter, generating steam at a pressure of 120 lb. to the square inch, the steam being carried in a steam main to the sewage pumping station opposite, and about 90 ft. distant.

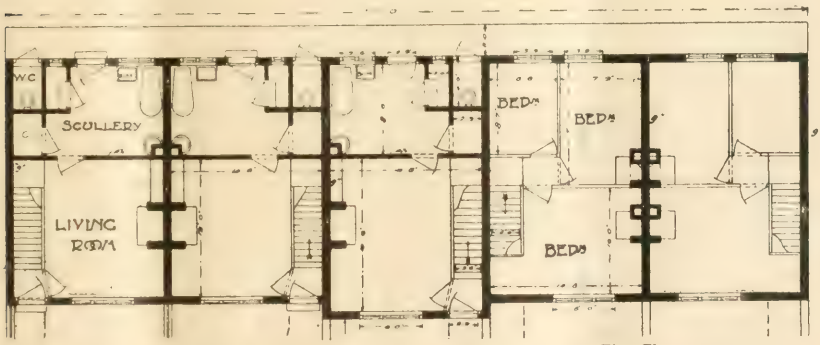
After leaving the boiler the hot gases are by no means useless, their temperature being from 800 to 900 deg. Fahr., the whole volume then passing through the regenerator or continuous air heater, heating the air supply for the forced draught blowers up to an average temperature of about 300 deg. Fahr. Still travelling towards the chimney, the hot gases are next utilised to heat the boiler feed-water in a Green's economiser, which has been recently added

three years ago, the reconstruction of the principal roads has been delayed.

Prior to the commencement of the war, a scheme was prepared for their reconstruction at an estimated cost of £46,000, which included wood-block paving for the High-street and London-road, and for the reconstruction of secondary roads with bituminous material or tar-macadam. At the commencement of the war the scheme for the wood paving, estimated at £20,575, was before the Local Government Board for their sanction to borrow, having been first approved by the Road Board and the county council, who had both agreed to contribute to the cost, but owing to the war the whole matter is now in abeyance.

Tarring of the roads has been carried out here for many years. Refined tar is used, and is applied by means of a Llewelyn & James machine, in which it is heated to about 200 deg. Fahr. Granite chippings of ½-in. size are used for covering in main roads and coarse sand in other roads. The cost of the com-

Front Elevation.



Ground Floor. First Floor.

Watford Housing Scheme: Block of Five Dwellings.

a "National" circulator. The feed-water is raised by the circulator from an inlet temperature of about 190 deg. Fahr. to an outlet temperature to the boiler of about 250 deg. Fahr. The gases pass forward into the chimney at a temperature of about 350 deg. Fahr., perfectly innocuous and freed from all dust.

The refuse destroyed at the destructor averages about 26 tons per day.

The dust, ashes and clinker are sold at prices ranging from 3d. to 1s. 2d. per ton at works, and are used for making concrete, mortar, road foundations, bacteria beds, &c. The tinned and galvanised scrap has also a ready sale in normal times.

It will be of interest to add that the destructor boiler supplies steam for running the whole of the sewage pumping and air compressing plant at the sewage pumping station, and is saving an annual coal bill of about £900.

HIGHWAYS.

The public highways, of which there are about 32 miles, are at the present time surfaced with either granite or gravel, with some short lengths in tar-macadam and Bitmac. Owing to the question of tramways for the town being under consideration for many years, and not finally settled until about

pleted work averages in normal years 12d. per yard super.

PRIVATE STREET WORKS.

Private streets are made up under the Act of 1892, and the specification adopted is briefly as follows:—

Roadway.—Hand-packed brick hardcore foundation 9 in. in thickness.
2-in. flint gravel consolidated to 6-in. thickness.
Norwegian granite channel, 12 in. by 6 in., laid flat on 6-in. cement concrete bed.
Footpaths.—Norwegian granite kerb, 12 in. by 6 in., laid flat on 6-in. cement concrete bed.
2-in. artificial slab paving on lime mortar bed.

The surface water and soil sewers are always laid by the estate owner when the roads are first laid out.

The cost for making up private streets immediately before the war averaged about £3s. 6d. per foot frontage for streets 36 ft. wide.

MUNICIPAL HOUSING.

In May, 1914, the council erected twenty-two dwellings in three blocks. Sixteen of these dwellings comprised each three bedrooms, 10 ft. 3 in. by 11 ft. 8 in., 11 ft. by 7 ft. 6 in., and 8 ft. 2½ in. by 6 ft. 8 in.; living room, 13 ft. by 11 ft. 8 in.; scullery, coal store, food store, and water-closet. The remaining six dwellings are slightly smaller, and have two

bedrooms instead of three. The full depth of each plot is 80 ft., and the building line is 7 ft. 6 in. from the road line.

As these dwellings were to be let at very low rents the cost of them had to be kept down to a minimum, and this has necessitated very plain work, both internally and externally.

The total cost of this scheme was £4,290, which included street works charges; the land had been purchased by the council many years ago for other purposes, the debt had been paid off and no charge for the land was introduced into the estimate or the balance-sheet for the scheme.

The larger dwellings are let at a rental of 5s. 4d. per week, which includes electric light, and the smaller ones at 4s. 10d. per week, which also includes electric light.

In August, 1914, the council was on the point of carrying into effect a scheme for an additional eighty dwellings, at an estimated cost of £20,252, but here again work has been interrupted by the war, and is in abeyance.

The proposed site adjoins the existing dwellings, and will be laid out with a new road 36 ft. wide, having 18-ft. roadway, two 9-ft. kerbed paths paved with one row of slabs and planted with trees.

In this scheme the blocks comprise four, five and six dwellings, and, with the exception of the six dwellings, which are slightly smaller and have two bedrooms, they have three bedrooms, a living room, scullery, coal store, food store, and water-closet. They will be finished in better style than the existing dwellings, and will let at higher rents, but building prices have altered so considerably that it is impossible to say at what rents the dwellings will be let.

ELECTRICITY SUPPLY UNDERTAKING.

The council's electricity supply undertaking was established in 1897, and has since been considerably extended. The area of supply is many times greater than the area of the urban district, and now comprises 25,000 acres. The system is a high-pressure alternating one, electricity being generated at 2,200 volts, and transformed in sub-stations to 200 volts, at which pressure it is supplied to consumers.

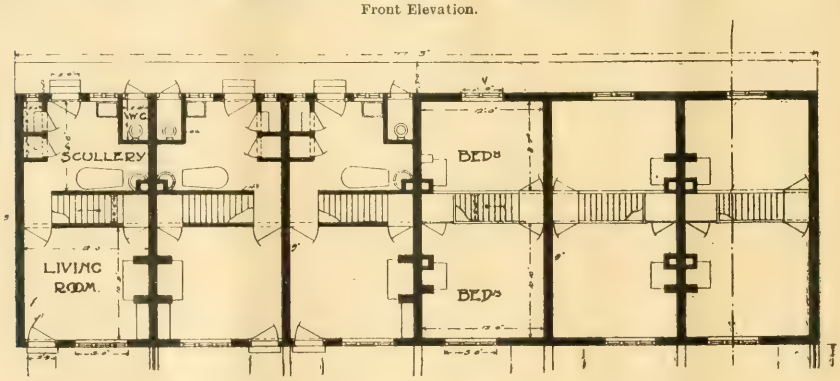
The distribution system comprises approximately 120 miles of high and low pressure mains laid underground.

The whole of the public street lighting is by electricity. (It may be remarked that Watford was one of the first towns to adopt electric street lighting throughout.) The current is supplied by a separate system of mains, and all the posts, which number about 1,100, are fitted with metallic-filament lamps. In addition to the ordinary lamps there are eighteen arc lamps at important points in the town.

During the twelve months ending March 31, 1916, the total consumption amounted to 2,250,000 units, of which approximately 1,500,000 units were for power supplies.

In conclusion, the author desires to acknowledge the valuable assistance he has received in connection with the water scheme and in the preparation of this paper from Mr. William W. Newman, ASSOC.M.INST.C.E., the deputy engineer; also the excellent work and efficiency of the other members of the staff, most of whom are now serving with the Colours.

Front Elevation.



Ground Floor. First Floor.

Watford Housing Scheme: Block of Six Dwellings.

NEWMARKET STREET LIGHTING CONTRACT.

COUNCIL REFUSE 50 PER CENT REDUCTION.

At the last meeting of Newmarket Urban District Council it was reported that the gas company had written requesting payment of the balance due on the year's lighting contract. This question has been outstanding for some time. Owing to the lighting orders, no gas has been used for public lighting during the year ending August 31st. The council offered the gas company £250 in settlement, which the company refused. Its manager now wrote: "Since on March 30th we offered to accept half the contract sum without prejudice, which offer your council declined, circumstances have materially altered, as the appeal of the Leiston Urban District Council *v.* the Leiston Gas Company which was pending has been dismissed. The judgment of Mr. Justice Low is upheld that the local authority is responsible for the full amount under the public lighting contract. Our case is precisely the same as Leiston, and probably stronger."

The council decided to adhere to their offer of £250 in full settlement, the resolution being carried unanimously.

Charts for Building Statistics.

By ARTHUR F. WICKENDEN, A.R.I.B.A., F.A.S.I., Deputy City Building Surveyor, Birmingham.

The compilement of statistical information should be by no means the least important of the duties performed by a municipal building surveyor's department. The available data, if plotted as various forms of charts, will result in a collection of most useful and at the same time interesting diagrams. This will obviously be particularly the case in large and growing towns where much work is always in progress.

The following examples of diagrams will serve to illustrate the system, and may also be suggestive of others to those officials who have to deal with this important branch of the public service.

The first figure is one of a series indicating the number of different classes of buildings completed during certain fixed periods, the classification being based on that adopted for the monthly returns required by the Board of Trade.

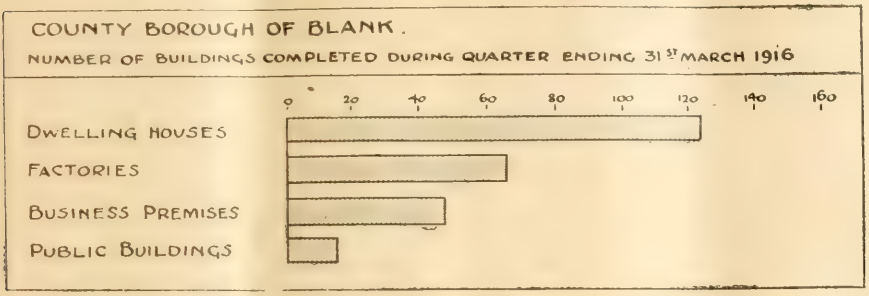


Fig. 1.

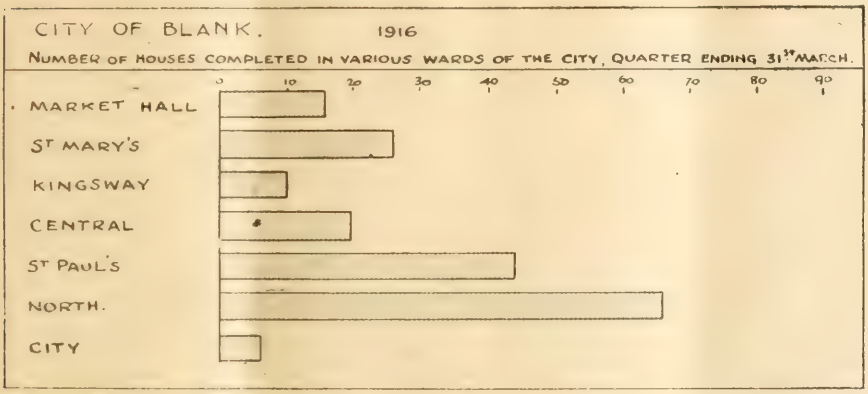


Fig. 2.

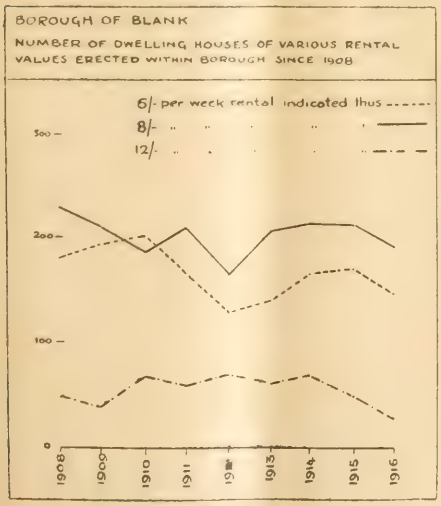


Fig. 3.

Statistics relating to the erection of dwelling-houses form most interesting charts, which will be found of much value at such a time as the present when the housing question is in the majority of localities so acute a problem.

Fig. 2 illustrates by a diagram the quarterly return of the number of houses completed in the several wards of a town. From it the most rapidly growing districts can be ascertained at a glance.

Fig. 3 is another very practical type of line diagram, showing the annual progress of residential building work relative to rental value. This example can easily be made more comprehensive by the use of different coloured inks for separate districts, thus graphically portraying the character of the development of the various areas of the town.

Many other variations of charts might be given, but they will readily suggest themselves to anyone interested in the subject. There can be no doubt that information thus recorded is more easily digested than complicated tabulations of figures.

The preparation of these diagrams will necessarily entail a certain amount of labour, but this can be reduced to a minimum if—as with any form of statistical work—the returns and tabulations are perpetually kept up to date. It is the making up of arrears that involves so much time and energy, and often leads to inaccuracy.

Method and regularity are absolutely essential in all such undertakings.

War and the Economic Aspect of the Housing Problem, with Special Reference to Mid-Lanark Housing Scheme.*

By WILLIAM ROSS YOUNG, Town Planning Engineer, Middle Ward of Lanarkshire.

On the many far-reaching changes which this great war will produce in our social and economic outlook, it is already obvious that one of the most prominent will be a general demand for an immediate and exhaustive inquiry into the conditions under which the masses of our people are housed. It is already known and admitted by persons representing all shades of opinion, as well as by Parliament, that our present housing conditions are rotten to the very core.

In considering this question two main factors will have to be taken into account. The first and more important is the relation of housing to the lives and health of our people; while the second—which is so often overlooked—is from a purely economic standpoint in which there is a close relationship between the health and physique of the people and their ability to increase the wealth and strength of the nation.

So far as national wealth is concerned, every efficient worker means a financial gain to the State, whereas every inefficient worker means a drag and financial loss to the State.

In dealing with the housing problem, therefore, Parliament will be urged to consider it, not only from a social, but an economic point of view, and to determine to what extent the spending of money by them on the provision of houses for the working classes will be a profitable investment. Our leading political economists are already agreed that, in view of existing circumstances, the erection of houses for the working classes is a matter in which State aid will require to be invoked in some form or other, and, indeed, the Housing (No. 2) Act, 1914, which provided about four millions sterling for subsidising the erection of working-class houses, was an admission by Parliament of this fact. Before the war the State had come to see that they could, by encouraging the erection of suitable houses, do much to save the lives and physique of our workers, and that from a national point of view it was a good and sound investment.

We now more fully recognise that our wealth and staying power as a nation is closely connected with the physique of the masses, and that the greater the number of efficient people that can be produced the greater our wealth and the longer our staying power will be.

At the close of the war the nation will have been greatly weakened, and it will be more than ever necessary to conserve by every means possible the health and lives of the people.

In that struggle between man and Nature which ever goes on, and where man calls to his aid every scientific device in order that he may more easily and cheaply abstract from Nature that which Nature is so reluctant to give up, there can be no doubt he has not, as far as house building is concerned, been able by science and mechanical power materially to reduce the energy, and consequently the cost, required in erection.

This economic factor has much to do with the acute housing problem we are now confronted with, and calls for a greater effort than ever before with a view to a solution.

The effect of bad houses on the nation cannot, unfortunately, be measured by death statistics alone, for how many of our slum dwellers while they live through this awful housing tragedy live only to propagate still weaker progeny. The question is being asked by every thoughtful person, "How long can our nation remain a premier one if steps are not taken to place the housing of our masses on a better and healthier basis?" This question was being asked before the war; it will be asked oftener now, and a definite solution demanded.

Cleland Housing Scheme, Lanarkshire. A Street View.

It was contended before the war that the financial resources of the nation were such as could not materially assist to a solution of this question. In the light, however, of the enormous resources which the war has shown the nation to possess, this plea, it is thought, will no longer be tolerated by the masses, for it is already being contended that if we can spend from four to five thousand million pounds on protecting ourselves from a foreign foe, then we can profitably spend the matter of another twenty million pounds in placing the housing of our workmen on a healthy basis, and the condition of which he has come to recognise as a deadly foe in his very midst.

Need for Reform.

As sanitarians and housing reformers we are bound to set our face strenuously and vigorously towards the solution of this problem, which we have long agreed must be dealt with in no half-hearted or stinted manner. There are millions of voices crying for reform in this direction to-day, and it is our duty to take immediate and definite steps. So long as we find thousands of families of five or six, or even nine, crowded in dark, one-roomed, insanitary houses, all the tuberculosis hospitals in the world cannot save

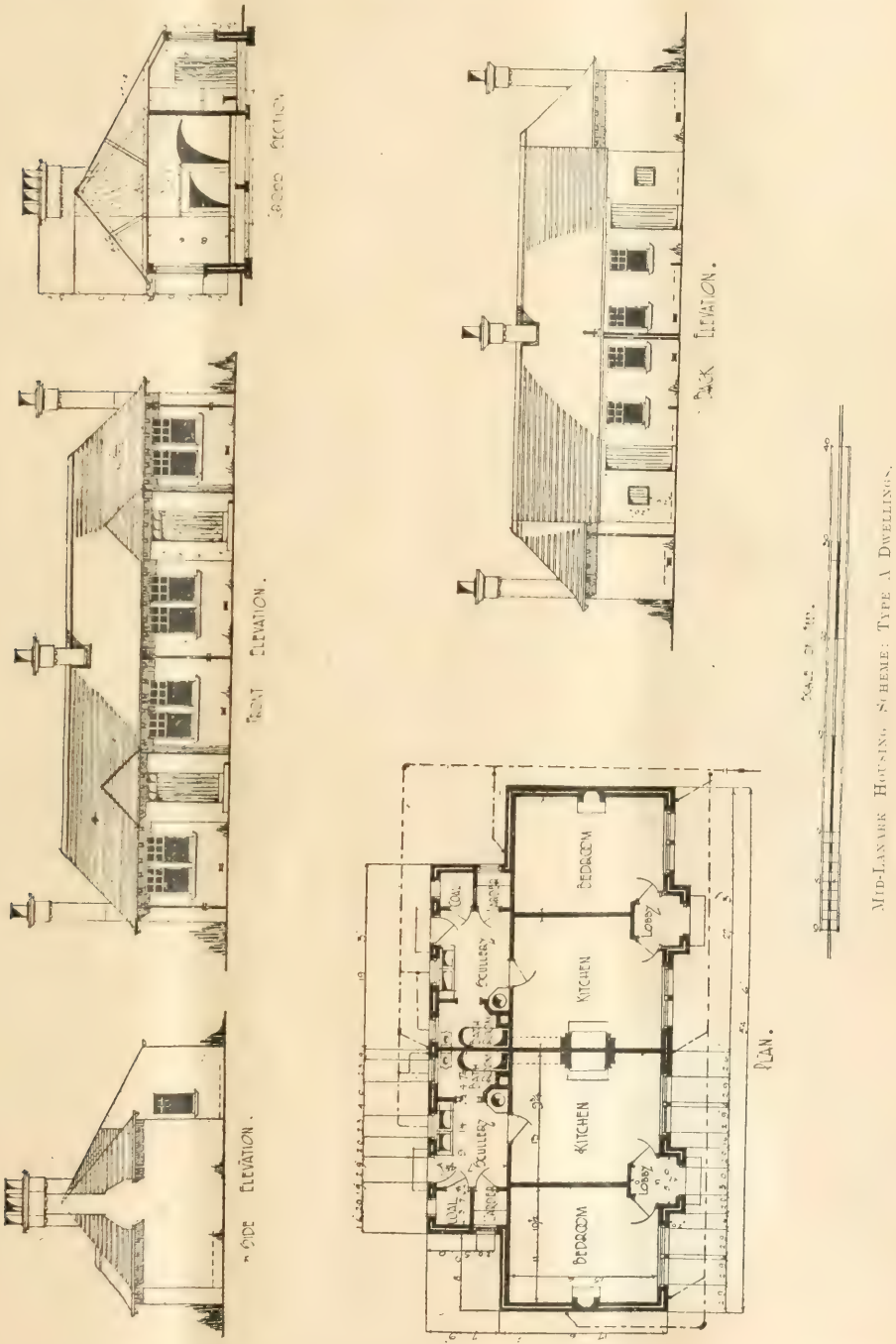
* Paper read at the forty-second annual congress of the Incorporated Sanitary Association of Scotland.

them from that deadly blow they are doomed to receive. There is no hope, under present conditions, for such families, and I we know it.

Until recent years housing was looked upon as purely a local and personal matter. It is now recognised as an Imperial and national obligation, and one which must call for the immediate attention of practically every local authority charged with the health and efficient housing of the people.

Some years before the war the erection of houses for the working classes by private enterprise became economically unsound, and even those speculative builders who, towards the termination of their career, tried to meet the situation by crowding the houses into high and deep tenements in the hope of saving land, roads, and other services, had in the end to give in, so that private enterprise, which in the past had provided 90 per cent of our workingclass houses, was gradually forced from the field by sheer economic pressure, and the public, for the first time perhaps in history, were met with a new and grave situation.

Local authorities at this stage, chiefly owing to the

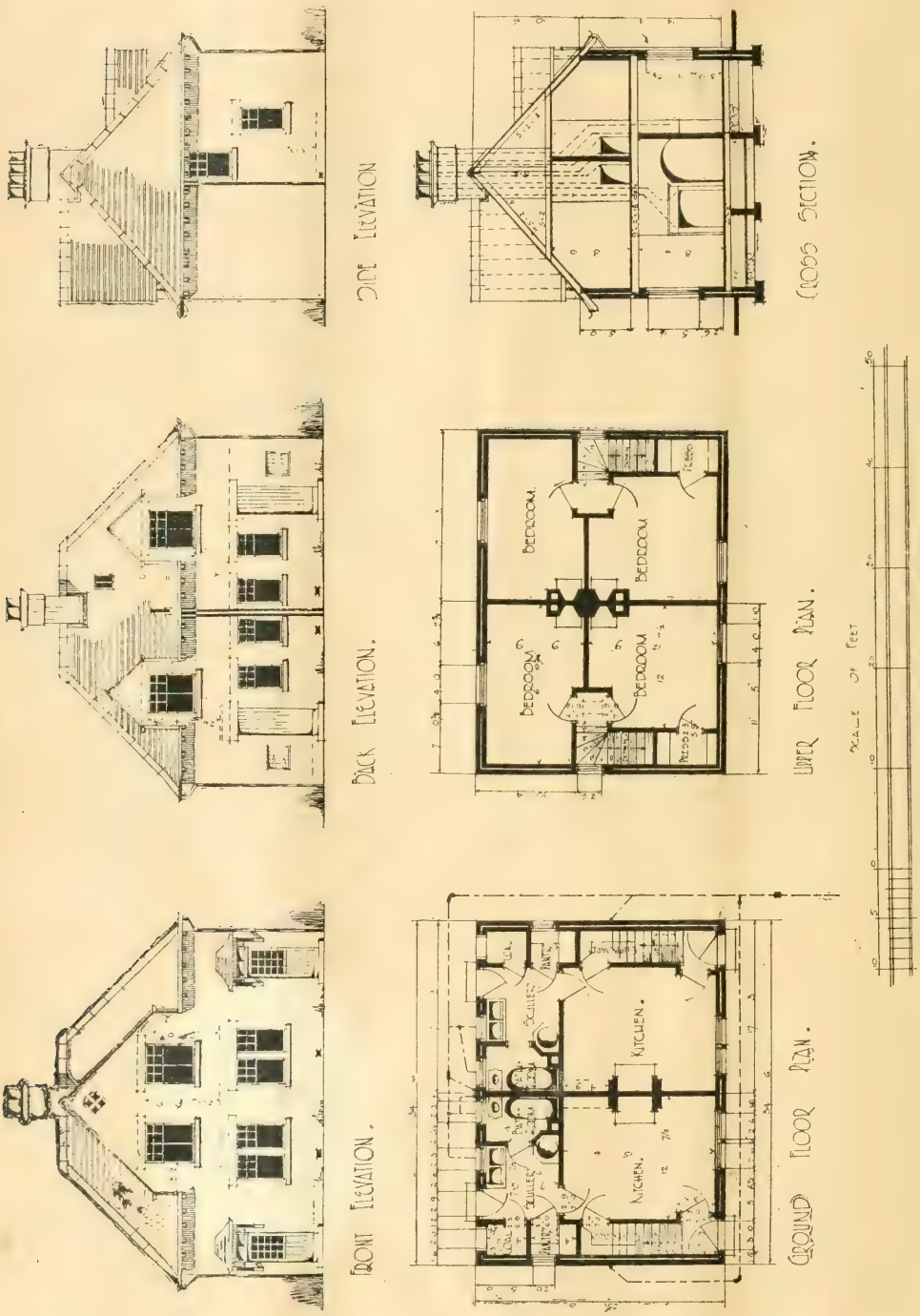


Mid-Lanark Housing Scheme: Type A Dwellings.

fact that they did not require profit from house building, and that they could borrow money on good terms, were still in a posit on to proceed with house build ng on an economic basis, and indeed most local

is no longer possible to build houses for the working classes at such a cost as will enable them to let the house at a rental which will cover their outlays.

The cost of building has gradually risen since the



Mid-Lanark Housing Scheme: Type B Dwellings.

authorities were moving in this direction when the war broke out.

EFFECT OF THE WAR.

The war, however, has changed the whole economic aspect of house building by local authorities, and at

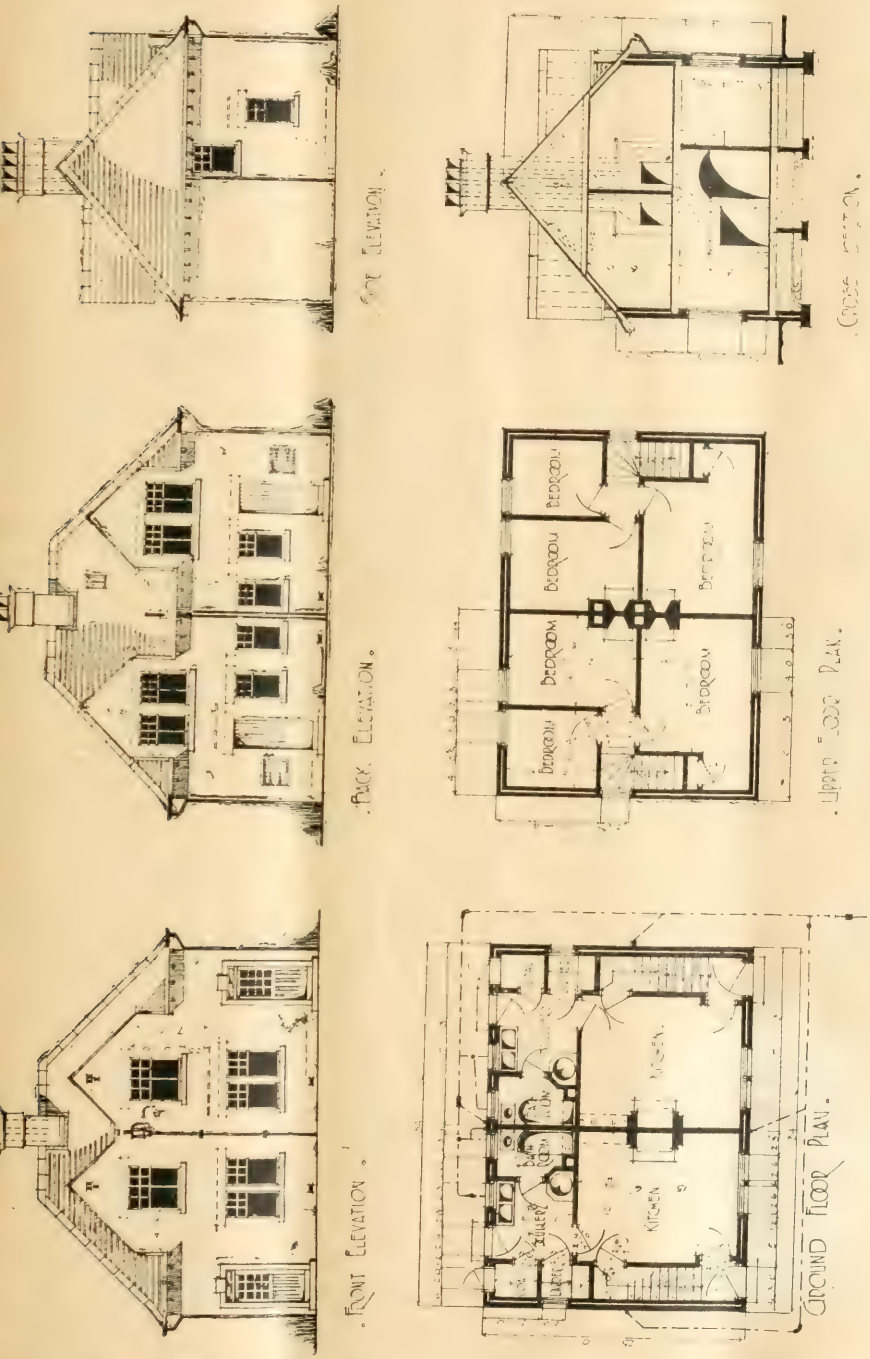
outbreak of the war, until it now stands at about 50 per cent above pre-war prices. In this connection I take type B (a two-room and kitchen house), shown in this report, as an example.

The Middle Ward District Committee took esti-

mates for this house immediately before the war broke out, and the cost, including roads and fencing, was £282.

In March last the estimate obtained for the same house was £340 showing at that time a rise of £108, or an increase of 46·55 per cent. It is believed that at the termination of the war the cost of cottage erection will gradually fall to some extent, but that it will never nearly reach the level it stood at before the war. The high rate of interest on borrowed money, together with the Imperial and local burdens, has also added largely to the difficulty of building on an economic basis.

It is suggested by some people that rents will rise immediately the Rent Bill is withdrawn, but even if this is found to be the case the rise will not be sufficient to meet the extra cost in building, higher interest, and other burdens. For example, before the war type B house, already referred to, could have been let at a rent of £13 15s. per annum on an eco-



Mid-Lanark Housing Scheme: Type C Dwellings.

nomic basis, while the erection of the same house to-day at a cost of £340 could not be let at less than £26 10s. if an economic rent were charged.

PUBLIC AND PRIVATE ENTERPRISE.

It has been suggested by some that the housing problem will gradually readjust itself without the intervention of the State or local authorities, and that their interference in the matter will only postpone the day when private enterprise will again enter the field, and this view is more particularly put forward by owners of property.

This inert procedure would, however, not only force up rents, but result in acute overcrowding during those years that would have to elapse before that economic equilibrium was reached when private enterprise could enter the field.

It is now generally recognised by those who have studied the problem that for a time at least local authorities will be asked by the Government to provide the necessary houses in their respective districts for the working classes, and that the Government will make such provision as will enable local authorities to let the houses at rentals comparable with those being charged for similar houses in the district. The exact form and extent which the Government will subsidise local authorities is so far a matter of conjecture. It is, however, thought they will grant subsidies in a form not dissimilar to that in which they have been proceeding in connection with the erection of houses for munition workers.

AFTER-THE-WAR PROGRAMMES.

Government departments have already warned local authorities of the necessity for having an "after-war programme" prepared with a view to meeting unemployment, and it is contended that all local authorities administering populous areas ought now to have a definite "after-war building programme" clearly laid down, so that an immediate start could, if necessary, be made at the termination of hostilities. In preparing this "after-war programme" local authorities will require to consider by which method they are to house their working classes, and it is specially with regard to this matter that some facts and figures relative to the Mid-Lanark housing schemes are now presented.

Before the outbreak of war the District Committee of the Middle Ward, in view of the overcrowding and lack of sanitary houses in their area, commenced a housing programme on a somewhat extensive scale, and at the outbreak of war they had taken in estimates in connection with two schemes involving the erection of 150 houses, and the erection of which was duly proceeded with.

Since then they have, at the request of the Minister of Munitions, undertaken the erection of a further 200 houses, while they have prepared plans and estimates for the erection of another 426 houses.

FIRST MATTER FOR CONSIDERATION.

The first matter local authorities will have to consider is the minimum size and standard of construction they are to adopt, and in this connection it may be stated that the Mid-Lanark District Committee have closely followed the recommendations of the various advisory and departmental committees which have reported on the matter.

They have erected a limited number of two-room and kitchen houses (Type A), a large proportion of two-room and kitchen houses (Type B), and a somewhat lesser proportion of three-room and kitchen houses (Type C). In every case there has been provided in connection with each house a scullery with wash tub, scullery boiler and sink, a bath-room, larder, and coal cellar, each house being fitted with hot and cold water throughout.

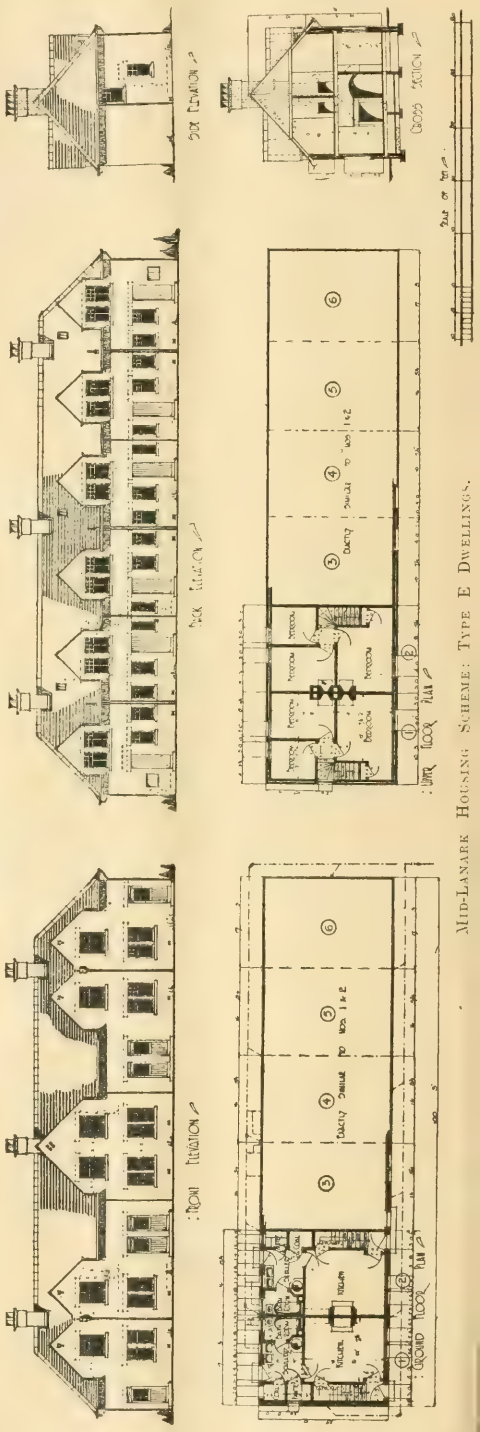
The whole of the houses are being erected in pairs, with garden front and rear. The mode of construction has been that of concrete foundations, 12-in. hollow brick walls, cement roughcast externally and plastered three coats on the solid internally, with slated roofs.

The size of the various apartments and the cost of these three types of houses as at October, 1915, is fully set forth and analysed in a table in this report.

The lay-out in each case has been on the garden suburb principle, and the density has been kept down to eleven houses per acre. The front building lines have been kept not less than 70 ft. apart, and 18 ft. as the average space between the ends of house. Open spaces and children's playgrounds are being introduced, while there has been a liberal planting of trees and hedges.

COTTAGE OR TENEMENT?

The question as to whether cottages or tenements should be erected by local authorities can be no longer in doubt, for the cottage system is proving to have every advantage over the tenemental system. The trend of public opinion is now—if indeed it has not always been entirely in favour of the housing



MID-LANARK HOUSING SCHEME: TYPE E DWELLINGS.

The Surveyor
And Municipal and County Engineer.

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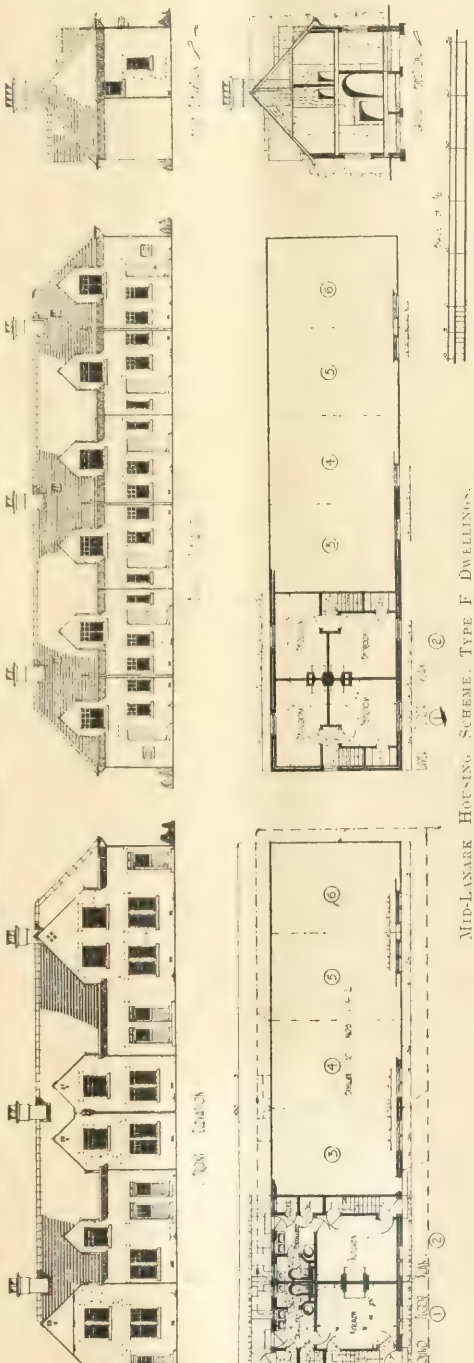
of our working classes in cottages in preference to tenements and local authorities may I believe, take it that except in very exceptional circumstances, grants will not be forthcoming or approval obtained from Government quarters where any attempt is made to house the working classes in a tenemental form.

The question of the difference in cost between a house in a tenement form from that of a cottage has been carefully analysed in many cases, and it has now been clearly demonstrated that our people can be accommodated in cottages as cheaply as in tenements. The Scottish tenemental system as against the English cottage system has long been looked upon as a national blunder, and all leading authorities on the housing question are agreed that the destruction of the tenemental system must be promoted as speedily as possible.

Under the Housing and Town Planning Act, it may be pointed out, local authorities can practically eliminate the tenemental system by using to the fullest extent their powers in prescribing the number, height, and character of buildings which may be erected. There can be no excuse in a large city when slum areas have been cleared for rehousing the people in tenements more or less on the Liverpool system, but there can be no excuse offered for the erection of those high and dense tenements which we see appearing in our industrial villages.

TERRACE HOUSES.

Having determined that houses of the cottage type are to be erected, it will then be necessary to consider whether the houses are to be erected in terraces of from four to eight, or whether they are to be built in pairs. The terrace system has greatly prevailed in both our English and Scottish garden suburbs. Practically the whole of the houses that have been erected at Rosyth are in terraces of from four to eight. The terrace houses have the advantage of giving in some cases a very pleasing architectural effect, while there is a saving as against double cottages. There is, however, a difficulty in connection with the access between front and back gardens. Terrace houses necessitate the construction of a back lane, which is rather undesirable, otherwise there is no means of access to the back gardens except through the houses or special passages. The District Committee of the Middle Ward had for their consideration plans drawn out and estimates taken in for terraces, and in each case it was found that the saving per house in terraces as against double



MID-LANARK HOUSING SCHEME. TYPE F DWELLINGS.

cottages—the house in both cases being exactly the same size—was approximately £10. Types E and F in this report show two of the terraces referred to.

(To be concluded.)

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bournemouth T.C.—A proposal has been approved for the provision of a secondary school for girls.

Durham T.C.—It is proposed to erect a public convenience at Park Wall.

Ebbw Vale U.D.C.—The council are asking the Local Government Board to sanction a loan for the adaptation of shop premises as a fire station, and for the conversion of the old fire station into council offices.

Essex C.C.—The Public Health and Housing Committee have authorised a further expenditure of £200 for alterations and additions to the Black Notley sanatorium.

Ilford U.D.C.—It has been resolved to approach the Carnegie Trustees for a grant towards a proposed swimming bath.

Norfolk C.C.—The county council have agreed to bear one-half of the cost of repairing Burgh Bridge, and the district council the other half. The county council have also agreed to do the work, and that in future the bridge and approaches should be repairable by the county at the joint and equal expense of the county and the district councils.

Nottingham T.C.—A scheme has been approved for the erection, after the war, of a new school at Bulwell.

HOUSING AND TOWN PLANNING.

Coalville U.D.C.—The council have tentatively approved a scheme for the erection of fifty artisans' dwellings after the war.

Dublin T.C.—It is proposed to hold a special meeting of the corporation at an early date to consider an offer made by the National City Bank of New York of a loan of £1,000,000 at 5½ per cent. in connection with housing schemes in the city. The Housing Committee recommend that the offer be accepted for an amount to cover the building schemes for Fairbrothers' fields, Spitalfields, St. James' Walk, and the M'Caffrey estate areas.

Foleshill R.D.C.—The surveyor and engineer, Mr. A. E. Newey, reported that thirty workmen's dwellings had been completed in Bedlam-lane and Elmsdale-avenue, Foleshill, at a cost of £6,597, and that the whole of the houses were now occupied at a rental of 7s. 6d. per week each. He reported further that twenty-four workmen's dwellings were completed and occupied at Wootton-street, Bedworth, and that the last six would be completed within a month.

Merthyr T.C.—The architect has received instructions to complete the housing scheme which has been carried out in part in the borough.

Silsden U.D.C.—The Buildings Committee have been authorised to prepare a housing scheme.

MOTOR TRANSPORT.

Clayton-le-Moors U.D.C.—It has been agreed to purchase a motor grass-mower for the open spaces department.

Dublin T.C.—It has been decided to purchase a motor van for the weights and measures department.

Forfarshire C.C.—The Dundee District Committee are considering the purchase of another road tractor.

Halifax T.C.—The question of the purchase of another light motor van for the parcels delivery service is being considered.

Reigate T.C.—The town council are considering the purchase of motor watering-vans.

Ripon T.C.—The Local Government Board are being asked to sanction the joint purchase of a motor fire-engine by the city council and the rural district council.

PARKS AND OPEN SPACES.

Carrickfergus U.D.C.—The council have accepted with thanks a cheque for £225 from Mr. C. M. Legg, J.P., to be used for the improvement of the public park. This is the third generous contribution Mr. Legg has made in connection with the park.

Edinburgh T.C.—The Public Parks Committee report that the revenue derived from bowling greens during the present year amounted to £608, from tennis courts £118, and from golf, since May 15th, £427.

Hastings T.C.—It has been agreed to postpone till after the war the laying down of a third bowling green at the White Rock Gardens, at a cost of between £300 and £400.

ROADS AND MATERIALS.

Blackpool T.C.—The town council have referred to the General Purposes Committee a proposal that statutory powers should be obtained if possible through the next local Parliamentary Bill for providing means of approach for vehicular and pedestrian traffic, either by subways or bridges, between the north and south sides of the railway line in the Talbot, Layton, Claremont, and Warbreck wards.

Chertsey R.D.C.—The council have agreed to adopt and repair the War Department roads at Chobham forthwith, and to apply to the department for payment of the sum of £100 promised in respect of the work.

Consett U.D.C.—The council are contemplating the purchase of a second-hand road roller.

Deptford B.C.—By way of experiment the borough council are putting luminous paint on some of the lamp-posts which are not being lighted.

Derbyshire C.C.—The Road Board have intimated that they will grant a loan of £480, free of interest, for the purchase of six trailer wagons for stone haulage.

Essex C.C.—The Highways Committee, in calling attention to the Local Government (Emergency Provisions) Act, 1916, which deals with the question of motor omnibus routes, reported they were in agreement with the principle adopted by the County Councils Association of the County Council acting as agents of the district councils under the Act.

Frimley U.D.C.—The council have agreed to an improvement scheme in Deepcut-road, at an estimated cost of £2,264, subject to receiving a loan of £1,132 from the Road Board free of interest.

Hailsham R.D.C.—The council have accepted a proposal by the Road Board in which they are recommending the War Department to contribute £456 in respect of work at Hooe-road, and £264 at Underlane.

Newmarket R.D.C.—The council have approved an estimate for road maintenance for the ensuing year amounting to £5,150, as against an actual expenditure of £10,070 in the previous year. It was stated that in order that the roads should not suffer a supplementary vote would be agreed to if necessary.

Newton Abbot U.D.C.—The council have purchased a property at The Avenue for the sum of £720, for the purpose of a stone depot.

Oswestry R.D.C.—The Road Board have written that they will recommend the War Office to meet two-thirds of the cost of improving Twmpath-road. The estimated cost of the work is £520.

Richmond (Yorks) T.C.—As the military authorities do not think the scheme sufficiently urgent to justify the expenditure, it was announced that the proposed construction of a new road from the town to the camp had been dropped for the present.

Seaford U.D.C.—The tender of Messrs. Henry L. Cooper & Co., London, at 18s. 9d. per ton, has been accepted for the supply of 500 tons of granite.

Wallasey T.C.—It was suggested at the last meeting that the standards indicating the tramway stopping places should be marked with luminous paint, as at present the standards were highly dangerous, while it was very inconvenient that on dark nights they could not be seen. Mr. Griffin, vice-chairman of the Ferries Committee, said that the matter would receive consideration.

Wandsworth B.C.—As an experiment for a month, the Highways Committee propose to extinguish all street lamps in the borough at ten o'clock at night.

Woolwich B.C.—The borough council have approved the action of a special emergency committee in agreeing to an estimated expenditure of £250 upon

laying wood pavement in part of High-street, Plumstead, where the London County Council propose to double the tram track. The cost of repaving the portion of the carriageway which the double line will be borne by the county council.

SEWERAGE AND SEWAGE DISPOSAL.

Bredbury and Romiley U.D.C.—The surveyor, Mr. R. Hardman, has received instructions to prepare an estimate of the cost of certain necessary repairs at the sewage works.

Darlington T.C.—The borough surveyor, Mr. G. Winter, has been instructed to lay part of the proposed new sewer at an estimated cost of £250.

Derby T.C.—The tender of Mr. G. F. Tomlinson, at £1,129, has been accepted for the construction of a sewer to the new works of the British Combustion and Chemical Manufacturing Company, Limited.

Foleshill R.D.C.—New bacteria beds have been completed at the sewage disposal works at a cost of £725.

WATER, GAS, AND ELECTRICITY.

Barking U.D.C.—The following tenders have been received for the work in connection with the proposed electric main extensions and plant, for which the Local Government Board have sanctioned a loan: Siemens Brothers & Co., cable, £1,913; General Electric Company, Limited, switchgear, £888; British Electrical Engineering Company, transformer, £611; Babcock & Wilcox, Limited, chain grate stoker and superheater, £602.

Batley T.C.—Sanction is being sought for a loan to instal new vertical retort carbonising plant at the gasworks.

Bermondsey B.C.—The borough council have approved the suggestion that the charge for electricity supplied by the council should be increased by a further 5 per cent. The price of coal and increased cost of carriage account for an extra expenditure of £4,922 for the year.

Chesterfield T.C.—The Local Government Board have intimated to the corporation that, after consultation with the Ministry of Munitions, they will sanction loans for carrying out extensions at the electricity works, and that the work may be put in hand at once.

Hereford T.C.—A plant for the recovery of benzol is to be installed at the gasworks, at an estimated cost of £200.

Kingston (Surrey) T.C.—The annual report of the borough electrical engineer, Mr. J. E. Edgcome, shows that the financial position of the electricity undertaking has improved, this being largely due to the increased charge for current. Whereas the nett deficit for the year ended March 31, 1915, was £1,295, the nett deficit for the year ended March 31, 1916, was reduced to £629.

Lancaster R.D.C.—Plans and estimates are to be prepared for a water supply for Priest Hutton.

Midleton (Co. Cork) U.D.C.—An estimate is to be prepared for the proposed extension of the water supply.

Poplar B.C.—The electrical engineer has been authorised to continue negotiations for the linking up of the electricity undertaking with that of Greenwich.

Redruth U.D.C.—The council have decided to engage the services of an engineer for consultation in connection with the proposed improvement of the water supply.

Salisbury T.C.—The town council are in communication with the Local Government Board with respect to a proposal to borrow £1,200 for additional pumping plant at the principal pumping station.

Stockton T.C.—The installation of a benzol oil washing plant is being considered by the Gas Committee.

Stowmarket U.D.C.—The Local Government Board have written stating that under present circumstances they do not feel justified in approaching the Treasury with a view to obtaining their approval of a further loan for the Stowupland water supply.

Wimbledon T.C.—It has been decided to make an advance of 25 per cent upon pre-war charges for electrical energy for all purposes, as well as hire of meters.

Worcester T.C.—It has been agreed to purchase ten 60 kw. transformers for the electricity works at £75 each, and the requisite switchgear at £250, making together the sum of £1,000, and to apply to the Local Government Board for sanction to a loan of £1,000 for payment of the cost.

Worthing T.C.—It has been resolved to take steps to lease Hill Barn Farm, near the corporation waterworks, it being explained by Councillor Aston that this was in accordance with the general policy of water undertakings to endeavour to control as much of the adjacent ground as possible.

MISCELLANEOUS.

Bambridge U.D.C.—It has been agreed to sell the steam fire engine to the Briton Ferry Urban District Council for £100.

Blackpool T.C.—The corporation have decided to promote a Bill in Parliament for power to construct two open-air bathing pools, and to carry out much-needed improvements to the cliffs to the north of the town, which are rapidly eroding through the effects of sea and weather.

Edinburgh T.C.—The tramway lease terminates in June, 1919, and the future of the system is being eagerly discussed. The Tramway Committee have agreed that disputed points between the committee and the tramway lessees should be submitted to arbitration. The principal point in dispute has reference to the condition of the tramway lines at the termination of the lease.

West Riding C.C.—The General Purposes Committee have considered a communication from the Decimal Association with regard to the adoption of the decimal system of coinage and weights and measures, but in view of the cost involved, and the difficulty of making the change, they have decided that no action be taken at the present time.

EFFECT OF TIDAL FLOW ON ARTESIAN WELLS.

Tidal flow affects artesian wells near the ocean, according to a report of the United States Geological Survey. In studying wells in the coastal plain of Virginia it was found that there was a decided variation in the well flow with the rise and fall of the tide, the flow being notably greater at the flood than at the ebb tide. It is the general opinion among well drillers that practically all flowing wells near tidal rivers or inlets from open bays do feel the distant sea, but some of them so slightly that the variation in flow is not noticeable.

The geologist in charge of the groundwater investigations in Virginia states that changes in water level in wells, due to fluctuations in the height of the surface of some neighbouring body of water, have been observed all over the world. It is customary to explain these changes by supposing a direct connection between the river, lake, or bay; but in many places, as in eastern Virginia, such connection is clearly impossible, owing to the depth of the wells and the nature of the intervening beds, some of them dense, tough marls and clays. These beds, however, though they do not transmit water, nevertheless contain it, and as water is practically incompressible, any variation of level on the river or bay is transmitted to the well through the water-filled gravels, sands, clays and marls. When a porous bed is tapped by a well the water rises to the point of equilibrium and fluctuates as the hand of the ocean varies its pressure on the beds that confine the artesian flow.

Town Planning Institute.—At a meeting of this body to be held on November 10th next, Mr. T. Alwyn Lloyd will read a paper entitled "Town Planning in Wales, with Special Reference to the Development of Hilly Sites."

The Working of the Summer Time Act.—The first meeting of Mr. J. W. Wilson's Departmental Committee to consider the working of the Summer Time Act will be held next week. Statistics in regard to the Act when in operation recently are being prepared, and witnesses will be examined as to difficulties which have been encountered.

Junior Institution of Engineers.—A special series of five lectures will be given on alternate Friday evenings from October 20th by Mr. E. Fiander Etchells, ASSOC.M.INST.C.E., A.M.I.MECH.E. The lectures will deal with the following subjects: A Common-sense Notation for Engineers; The Practical Use of Units in the Evaluation of Formulæ; How to Memorise Formulæ; Logic of the Differential and Integral Calculus; Practical and Illustrative Examples of the Application of the Newer Concepts.

PERSONAL.

Mr. G. F. Grimwood has been appointed surveyor and inspector to the Boston Urban District Council.

Mr. W. A. Parry, Pontypridd, has been appointed surveyor and inspector to the Llandilo Urban District Council.

Mr. L. Tait, surveyor and inspector to the Norton (Yorks) Urban District Council, has had his salary increased by £20 per annum.

Mr. T. A. Kennedy, temporary clerk in Surbiton surveyor's department, has had his salary increased from £104 to £130 per annum.

Mr. C. C. Else, Fritchley, near Derby, has been appointed temporary highway surveyor to the Claypole (Lincs) Rural District Council.

Mr. A. J. Firby, of Holbeach, has been appointed highway surveyor to the Northern District of the Southwell (Notts) Rural District Council.

Mr. J. Kitney, highway surveyor to the Elham (Kent) Rural District Council, has been appointed surveyor to the Hollingbourne Rural District Council, at a salary of £200.

Mr. F. W. Richardson has been appointed deputy surveyor and inspector of nuisances to the Lunesdale rural district during the absence of Messrs. J. Thompson and E. Ellis on active service.

Mr. W. Bangor Jones, assistant surveyor and sanitary inspector, has been appointed surveyor to the Bredbury and Romiley Urban District Council, in succession to Mr. R. Hardman, resigned.

Lieutenant J. S. Smith, 4th Highland (Mountain) Brigade, R.G.A., has been attached to the 143rd Army Troops Company R.E., and is now engaged on road engineering at the Balkan front. Lieutenant Smith was road surveyor of the Campbeltown district of Argyllshire when war broke out.

Mr. J. Ennor, surveyor to the Newquay, Cornwall, Urban District Council, has suffered a bereavement by the loss of his son, Private Reginald C. Ennor, aged twenty-five, who died on Tuesday at Leeds Military Hospital of wounds received in action. At Wednesday's meeting of the council a vote of sympathy was passed with Mr. Ennor.

Temp. Sec. Lieut. A. R. Howlett, Royal Engineers, in civil life a member of the borough engineer and surveyor's staff, Bethnal Green, has been awarded the Military Cross. Mr. Howlett received the ribbon of the Cross from Lieut.-General Claude Hamilton on September 9th, at a field ceremony in France. The *Gazette* states that the decoration was awarded for "conspicuous gallantry during operations. He established a forward dump of R.E. stores, passing backwards and forwards through a heavy barrage. He showed the utmost coolness and determination."

Messrs. N. Barnett-Weekes, Liverpool Corporation, J. Eastwood, engineer and surveyor to the urban district council, Sowerby Bridge, A. A. Goodall, engineer and surveyor to the urban district council, Rhyl, and W. Quest, surveyor to the urban district council, Wombwell, have been elected members, and Mr. H. T. Hamer, engineering assistant to borough engineer, Barrow-in-Furness, has been elected an associate member of the Institution of Municipal and County Engineers. Messrs. J. H. Skidmore, articled pupil to engineer and surveyor, Wellington Urban District Council, and T. M. Tyson, articled pupil to county surveyor, Cumberland, have been elected students of the same body.

Mr. H. F. Wilkinson, Assoc.M.Inst.C.E., acting engineer to the Tottenham and Wood Green Joint Drainage Board, is to be congratulated upon the energy and zeal he has displayed, and the results he has accomplished in connection with a local scheme of land cultivation. At the request of the Tottenham District Council he took in hand the whole question of the provision of allotments, acted as secretary for, and carried through all the formalities necessary for forming a society under the Industrial and Provident Societies Acts, successfully bargained for suitable land, and, besides a hundred and one other things, placed the whole concern on a sound financial basis. His interesting speech to the members of the association recently, of whom there were several hundreds present, was listened to with the greatest attention and evoked stirring applause. Mr. Wilkinson stated that by May 24th he had received applications from thirty-seven persons for an area of 420 poles. By July 26th, however, the number of applicants had increased to 480, and the area to 5,221 poles.

OBITUARY.

Mr. T. Johnston, formerly road surveyor to the Renfrewshire Road Trustees, died recently, we regret to state.

MUNICIPAL SCHEMES AFTER THE WAR.

Clown R.D.C.—The register of proposed works includes new council offices and stores, and private street works.

Gower R.D.C.—The council have scheduled the following schemes: Penclawdd sea wall, £700; construction of the Penclawdd-Gowerton road, £5,000; improving dangerous corners, £300.

Hemsworth R.D.C.—The council have decided to particularise highway improvements; the provision of scavenging depots; cemetery extension; housing schemes; and private street works.

Luton T.C.—The General Purposes Committee have resolved that the Local Government Board be informed that the following works, which are in abeyance owing to the war, will probably be undertaken by the council: Dallow-road extension and sewerage, railway footbridge, Denbigh-road school, main drainage extensions, infectious diseases hospital extension, and making up of private streets.

Newmarket R.D.C.—It is anticipated that the Soham water supply scheme will be proceeded with.

Northfleet U.D.C.—The paving of London-road with wood; relaying wood paving in High-street; the widening and improvement of Roman-road; and a housing scheme.

Southwick U.D.C.—The provision of an elementary school at Fishergate is contemplated, as well as somewhat extensive street works.

Wandsworth B.C.—A report has been prepared showing projected schemes either approved, deferred, or suggested, estimated to cost £362,131.

Watford U.D.C.—Housing scheme, £20,000; sewerage, £16,000; pipe lines and mains, £16,200; waterworks, £12,100; wood paving, £20,575; tennis courts and bowling greens, £5,000; and a public library, £7,500.

West Hartlepool T.C.—The construction of a new road between West Hartlepool and Easington; and (by private firms) the construction of a new shipyard at Tees Mouth, and the building of a new railway station.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Barrow-in-Furness T.C.—£100 for a tuberculosis dispensary.

Bury T.C.—£600 for electric mains.

Dudley T.C.—£473 for sewerage works.

Exeter T.C.—£1,215 for a temporary smallpox hospital.

Wednesbury T.C.—£3,500 for electricity mains and services.

LOANS SANCTIONED.

Barking U.D.C.—£4,250 for electric main extensions and plant.

Stafford T.C.—£1,579 for gas-washing plant.

Waterford T.C.—£1,000 for the electric lighting scheme.

LOAN REFUSED.

Upholland U.D.C.—£1,800 for laying a water main.

FORTHCOMING INQUIRY.

OCTOBER.	£
18.—**Kempston.** For the purpose of sewage disposal (Mr. P. M. Crosthwaite) ...	1,831

FOR OTHER ADVERTISEMENTS
See End of Paper.

TEMPORARY CLERK required (ineligible for military service); previous municipal experience desirable. Apply, giving full particulars of present employment and salary required, to the Surveyor, Erith Urban District Council. (3,129)

Municipal Waterworks Association.

FIFTH ANNUAL MEETING IN LONDON.

The fifth annual meeting and conference of the Municipal Waterworks Association was held on Friday last at the rooms of the Metropolitan Water Board, Savoy-court, Strand, W.C. The president, Lieutenant-Colonel R. S. Porter, J.P. (Liverpool Corporation Waterworks Committee), took the chair, and the attendance included Messrs. R. S. Carter (Liverpool), W. Terrey (Sheffield), L. C. Walker (Reading), J. Terrey (Liverpool), A. Lees (Birmingham), J. Johnston (Brighton), J. Cook (Blackpool), J. Watson (Bradford), J. Sutherland (Glasgow), A. P. Pilling (London), F. B. Parfitt (Reading), D. Shenhouse (Glasgow), D. Mason (Glasgow), W. Maclure (Glasgow), J. H. Taylor (Barnsley), F. Cullough (Belfast), F. J. Dixon (Ashton-under-Lyne), C. Arthur (Blackpool), W. R. Barnett (Keighley), R. Pickersgill Leeds), A. Harrison (London), G. T. Edwards (Leicester), J. Ward (Derby), I. M. Rush (Edinburgh), W. Boyd (Edinburgh), J. E. Swindlehurst (Coventry), H. Cawte (Southampton), L. Mitchell (Bolton), J. F. Jupp (Abertillery), G. F. Carter (Croydon), S. F. James (Ilkeston), C. Horobin (Lincoln), J. Armour (Saltcoats), G. Christie (Kilwinning), E. C. Rodda (Southampton), R. E. Ford (Doncaster), F. W. Davis (Nottingham), R. K. Pinches (Edinburgh), W. A. Carter (Edinburgh), and J. Murray (Edinburgh).

The fifth annual report stated, *inter alia*, that the membership of the association now embraced fifty-six municipal water authorities, numbering over 150 representative and individual members. The total capital expenditure represented was £118,319,000, and the population supplied by the various authorities approached 20,000,000 persons. Forty-two of the water authorities represented were in England, ten in Scotland, three in Wales, and one in Ireland.

REVISING THE BY-LAWS.

The preliminary business included the consideration of the revised by-laws, the draft of which was submitted by the executive committee. It was explained by Mr. A. P. Pilling (London) that the arrangement of the by-laws had not been convenient, and that there was therefore some lack of confusion. They had been rearranged and regrouped, with the object of accentuating the idea of the association to secure to the utmost lay support. It was desired that corporations and members of corporations should compose the bulk of the membership. The old by-laws were framed in such a way that an officer of a corporation would be a member even if the municipal body had not joined or were not represented in any way. That was not in accordance with the idea that they should be a municipal and lay association rather than a gathering of officers. It had been thought desirable to provide that membership by the municipal authority should be a condition precedent to membership by the individual.

The chairman, in answer to a question, said the proposal did not mean that where the municipal authority to which a member belonged had not joined the association the officer in question would be requested to retire; but in future no official of a corporation or local body could be a member of the association unless the authority which he represented were in membership.

The revised by-laws were eventually approved, and it was agreed that the publication of the "Quarterly Circular" should be continued during the year ensuing, several members commenting upon the specific value of this publication, and the marked ability displayed in connection therewith by Mr. G. P. Warner Terry, the secretary.

Lieut.-Colonel R. S. Porter was re-elected chairman; Mr. E. Antony Lees, hon. treasurer; Messrs. C. G. Henzell and William Terrey, hon. secretaries; Mr. Walter Moon, hon. solicitor; Messrs. C. Arthur and R. Hamilton, hon. auditors; and Mr. G. P. Warner Terrey, secretary, votes of thanks being accorded to these gentlemen for their past services.

THE PRESIDENTIAL ADDRESS.

The chairman in the course of the presidential address alluded to the ill-luck which had attended the gallant son of Mr. James Watson, of Bradford, Lieutenant-Colonel Watson, who, after having been invalided home, returned to duty, and on the very first day he found himself again in the trenches was taken a prisoner of war. Lieut.-Colonel J. R. Davidson, engineer of the Liverpool Waterworks, who joined the Scottish Territorials as a private in 1900, and who rapidly rose to the position of Major, went to France in 1914, was wounded, and had achieved the distinction of Commander of St. Michael and St. George. The Board of Trade, he proceeded to say, had refused to budge from the attitude they had taken up with respect to the demand for equitable terms in reference to the insurance of waterworks against the risk of damage from hostile aircraft. The attitude taken up by the Treasury towards waterworks undertakings had not been satisfactory. There appeared to have been a complete want of a proper sense of proportion as regarded the necessities for the expenditure of capital on waterworks and other enterprises. He adverted in particular to the instances of Bradford and Liverpool, and after commenting upon the valuable work done by women in the absence of the men at the Front, he referred to the attitude that would have to be taken up in future in regard to science. Education, he said, must no longer be left to the domination of the old tradition of Oxford and Cambridge, and it must no longer be thought that a man was educated because he construed Cæsar, and could read the Greek alphabet. They had to congratulate at least two or three of their members upon work which had been achieved during the year. The inauguration of the scheme for securing increased supplies to Aberdeen according to the plan of Messrs. Roberts & Hogg had received general attention because of the use of the excess lime treatment upon a large scale. Mr. C. H. Roberts, water engineer of Aberdeen, was a member of the association, and they trusted that Aberdeen would be more than satisfied with the works which had recently been established. They had also to compliment Mr. Charles Massie, engineer of the Falkirk and Larbert Water Board, upon the water pressure regulating apparatus, and the effective device designed by him to shut down automatically the pumping set during the period of light load. Mr. Rodda, of Southampton, had also deservedly earned the compliments of his authority for the success which had attended his efforts in securing economy by the adoption of up-to-date engineering wrinkles, and Southampton had also to be envied in that Mr. Rodda had found for them at Otterbourne what was practically an unlimited supply of water of an almost ideal kind and quality at a ridiculously low cost. Engineers in this country, he proceeded to say, were far too insular in their outlook generally. A water engineer who wished to be up to date could not ignore the progress or discoveries that had been made by those engaged in other branches of the profession. They as an association were hoping to cater for a much younger type of engineer at present engaged in the smaller works, who was ambitious not only to secure some of the more valuable appointments in this country, but was ready to carry British engineering in waterworks to all parts of the globe. Hence the bibliograph which they had started, and which, as far as he knew, existed nowhere else. As time went on this would prove of the greatest utility to the members of the association.

WATERWORKS AND THE WAR.

Mr. J. Cook (Blackpool), in the absence of Alderman J. Bickerstaffe, chairman of the Fylde Water Board, moved: "That this association suggest that the Local Government Board or other Government Department, by Act or Order, or in some authoritative way, extend all periods of time granted to water authorities previous to the war for the carrying out of obligations and the execution of works for the period of the war, and a further period thereafter, to allow the country time to settle down to something like normal working conditions." The mover stated that it would be rather hard if every municipal authority that had works in hand, or in prospect, should have to go to Parliament in order to obtain relief. It would be preferable if the Government passed an Act or Order to deal with such cases.

Mr. W. Terrey (Sheffield) seconded. He thought they might claim an extension of the period for the

repayment of capital moneys, or a suspension of the sinking fund during the war.

Mr. D. Stenhouse (Glasgow) said he thought the object aimed at was already obtained under the Extension of Time Act, by which it was competent for a Government Department to grant extension for the period of a year, at the expiry of which the application might be renewed.

Mr. A. P. Pilling (London) agreed with the last speaker. Personally, he had found no difficulty in getting extension under the Act mentioned. He did not agree with the remark made with respect to the suspension of the sinking fund. Boroughs were boasting about reducing rates, and as these were times of amazing financial prosperity, public authorities ought to discharge their obligations to the utmost so as to reduce the burdens in the future. He suggested that the resolution should be referred to the Executive Council of the association, and this course was eventually adopted.

LEAVING CERTIFICATES.

Mr. W. Terrey (Sheffield) mentioned that the executive council were negotiating with the Government on the subject of leaving certificates for men engaged on waterworks, and the meeting approved the steps taken.

THE ACQUISITION OF LAND BILL.

Mr. C. G. Henzell, M.INST.C.E., waterworks engineer to the Leeds Corporation, proceeded to read a paper on the "Defence of the Realm (Acquisition of Land) Bill." In the course of the brief discussion that ensued.

Mr. J. Cook (Blackpool) asked if there had been any general request addressed to Members of Parliament on the subject.

The Chairman said that doubtless the members of the association would endeavour to interest their Members of Parliament and get the Bill so altered and amended that it would not tend to the prejudice of the water undertakings.

Mr. J. Watson (Bradford) observed that the Bill interfered in a great many ways with the protection and purity of the water supplies. The domestic water supply was safeguarded, but, as a rule, the supply for commercial uses was almost as important and essential as the domestic supply, for if there was no commercial use for water there would be no use of water at all for domestic purposes. He thought that both these essential facts should be kept in mind.

Mr. Carter (councillor, Edinburgh) supported the policy of approaching Members of Parliament in order to obtain necessary amendments in the Bill.

Mr. Rusk (Edinburgh) suggested that a small committee should be formed to see if further stringent amendments should not be added.

The Chairman stated that matter was being seriously considered by the Association of Municipal Corporations, and he thought it might be safely left in their hands.

Mr. A. B. Pilling (London) agreed that it would be better that one body should take up the Bill than that amendments should be proposed by various associations, and it was understood that this course would be adopted.

SOME RECENT LEGAL DECISIONS.

Mr. Walter Moon having read a paper on "Recent Cases of General Interest Affecting General Water Supply Undertakings,"

Mr. E. A. Lees (Birmingham) remarked that in Birmingham dentists were supplied by meter where there was a considerable demand, with a provision for a minimum.

Mr. James (Ilkeston), referring to the case of the dentist, asked whether the result would have been the same if the claim had been made under sec. 20.

Mr. Moon, in reply, stated that the board could have refused to supply except under sec. 20, but they did not raise that question at all.

MUNICIPAL ENGINEERS AND CONSULTANTS.

Mr. M. R. Barnett (Keighley) stated that a reference had been made in one of the journals to the question of municipal engineers and consulting engineers. Had the executive committee taken action with reference to the subject, which had met with the disapproval of the Association of Consulting Engineers?

Mr. James Watson remarked that the consulting engineers did not seem to be content with the parent engineering institution, of which many present were old members. They claimed that they themselves were the people who should be consulted. He (Mr. Watson) did not believe in tying up officials like an ox in a stall. He, as a municipal engineer, had never been tied down in all his long life, and he believed that mutual help was beneficial. Their own association might indicate that they did not think they had been fairly treated by the endeavour to bring between officials of a corporation and councillors something derogatory to municipal service.

Mr. Barnett observed that, after all, they might take it as a compliment, because it could only be jealousy that had influenced the body referred to.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not a sign of the times, and of municipal economy, when we read that the Southport Council declined to ratify a resolution of the Tramways Committee to send a deputation to attend the conference of the Municipal Tramways Association in London, one of the aldermen, in moving its rejection, remarking that "this was no time for picnics in London"? Did not the same sort of thing occur at Hinckley, where the sanitary inspector desired to attend the annual conference of the Sanitary Inspectors' Association at Cardiff? Is it not a question whether these small economies are of any use unless larger economies are practised?

* * * *

Apropos of these municipal economies, was it not a rather drastic suggestion of a member of a certain rural district council to propose the termination of a scavenging contract in one of the parishes of the authority's area, the claim being made that, while a 1s. 6d. rate would be saved, no harm would follow, as out of 300 parishes in Leicestershire only thirty were scavenged? Although this suggestion was not carried, does it not seem to be rather remarkable, if true, that there should be 270 parishes in the county of Leicestershire where the scavengers' visits are unknown?

* * * *

With regard to the experiment of laying wood blocks only 2 in. in thickness in an American city, which was described in The Surveyor of September 22nd last, has not the difficulty always been with such thin blocks that they soon become loose and are apt to lift? Although it may be perfectly true that when a block wears down about an inch and a-half the road surface becomes bumpy and uneven, is not the want of key and sufficient side support fatal to the use of thin blocks, except when laid on the system known as the "Acme," in which small and thin blocks of wood, properly keyed and fastened together, have been laid in this country with surprisingly good results?

* * * *

Was it not rather surprising to find in a recent issue of that essentially mechanical engineering journal *Engineering* an excellent leading article on "The Preparation of Schemes for Arterial Roads"? Does it not show that the question of roads has now become a real engineering problem, and that the methods which have been pursued ever since the days of Macadam and Telford can no longer be continued, but that the road of the future will have to be constructed on advanced and modern lines?

* * * *

Does it not seem strange that the rural district council of Cardigan were able to command the services of a road surveyor at the magnificent salary of twenty-one shillings a week, and was it altogether surprising that there should have been considerable discussion as to whether this princely salary should be raised to twenty-five shillings a week, and that this extravagance on the part of the council was only carried by a very small majority of reckless spendthrifts?

* * * *

Did not Mr. T. M. McElroy make out a very good case for tramways *versus* motor omnibuses at the recent annual conference of the Municipal Tramways Association? But did he not base his arguments on the financial question as regards peak loads rather than that of congestion of street traffic? Is there anyone now who can defend the rigid tramcar against the accusation that it is by far the most objectionable vehicle as regards the general traffic that could possibly be put on our streets or roads and compares very badly in this respect with the mobile motor omnibuses? Besides, after all, were our streets and roads ever intended to have railways constructed on them?

Opportunities in Town Planning.*

By J. W. COCKRILL, M.INST.C.E., Borough Surveyor, Great Yarmouth.

But for the strangle hold which the war has had on the country, and the financial straits which it has created, the progress of town planning would have been much more than it has been, and all that the author of the Act could have wished. It is to be hoped that when the war has finished its course the financial trouble may be overcome, and that a large number of towns may avail themselves of the advantages which the adoption of the Act offers.

There may be disappointment that in the seven years since the passing of the Act only 160 schemes are in various stages of progress, and that of these only six are complete. These numbers would have been very considerably increased but for the war, which throughout the country has depleted the official staffs so much that ordinary routine work cannot be carried out. Work considered as immediately necessary has had to be deferred, especially as in the negotiations with the owners the officials find that no steps will be taken while the war lasts.

The need for providing dwellings is known to be very urgent throughout the country. It may also be expected that employment will have to be provided for men returning to their usual occupations either from the fighting-line or from munition works after the war has ceased. The local authorities who are not prepared with schemes for housing and town planning will find themselves at a disadvantage. It is only reasonable to suppose that the Local Government Board will require that all plans submitted to them for the purpose of obtaining sanctions for loans or grants, in the event of any such being obtainable, shall strictly comply with the best conditions, and that the lay-out of their sites shall not in any way contravene any scheme of town planning, and if no scheme is in progress that the development of the district on correct lines shall not be impeded by any proposal. It might be even advisable that the local authority should be compelled to provide a preliminary plan which would show how developments in the district are likely to be affected by the work for which the sanction or loan is asked.

MISTAKES OF THE PAST.

If this is done it may be assumed that we shall avoid the mistakes and dreadful examples of the last century, by which the English workman's house while being his castle in that he has had a separate dwelling, has resulted in his living in the dreariest groups of residences to be found. By-laws before 1880 permitted almost any number of houses up to a hundred per acre, including roads and passages; the packing is then so dense that one does not know if the planning is of the chess-board pattern or any other system.

The much-maligned by-laws of the Model type, whatever may be said about them, have done much to secure to each house some breathing space in wider roads and backways. That the breathing space was in straight lines and right angles is the fault of the person developing the land with only the idea of getting the largest number of buildings on an acre, with the smallest number of bricks, and in such a way that the buildings would hold each other up and give the builders a chance of making a profit. Æsthetic conditions cannot be secured by by-laws, and there may be even difficulties under town planning powers, but something might surely be done in securing the air space about the house if by-laws were permitted to be prepared allowing a reduced standard of construction and width in new streets where houses did not exceed a certain number per acre. Provisions could be made by which the front lines of the houses could be kept a minimum distance apart, say 80 ft., and if the same distance apart were allowed between the backs of the houses it will be found that the number would work out at twenty per acre, which is considered too large by the best authorities. Limiting the number of houses in a group or terrace by reasonable restrictions as to the distance between each group of houses will result in about sixteen houses per acre.

Concessions in road making could then be reduced to provide only such a standard of width and heaviness of metalling to the carriageway as would be necessary to provide a proper approach to the dwelling-houses if no through traffic was developed by the construction of the road. In cases where heavy through traffic might afterwards be developed requiring a greater standard of width and heavier metalling, the local authority should have the right of taking the ground free whenever they determine to carry out the work involved in such widening and heavier metalling. The way to secure better homes for the people seems to be to create discontent by educating them to expect a very different class of house to the badly planned, inconvenient, and generally badly built houses now arranged as square boxes in rows of indefinite length and uniform to the door knocker.

APPEAL TO THE SPECULATIVE BUILDER.

In this connection, Mr. Mulford Robinson, in his "City Planning," quotes from Mr. Charles Booth the following passage:—

"I wish I could rouse in the minds of speculative builders a sense of the money value that lies in individuality, with its power of attracting the eye, rooting the affections and arousing pride in house and home. Then would they seek to use in place of sedulously destroying every natural feature of beauty, and take thought of others; a slightly greater width of garden on the sunny side, whether front or back, may make all the difference; a single tree left standing can glorify a whole street. Fresh painting and papering within is not the highest ideal—its charm passes; the other gathers force as the years go by."

And Mr. Robinson completes an extremely interesting chapter with the following:—

"It is with that spirit that the planting of tracts for humble homes must be undertaken. There must be the freedom from restraint that was craved in the planning of the high-class minor streets; not symmetry and exactness, but the best practical housing of the poor, the brightening of their lives, and the fostering of the home spirit should be the aim.

"If we succeed in this, substituting these gifts for dark courts and dreary streets, where there is not sufficient light and air for the health of body or spirit, we may expect that more grandiose town planning projects will grow easily out of the new-born civic spirit."

The objects set forth so ably by Mr. Booth and Mr. Robinson are obtainable under town planning powers by a wise lay-out of the area which, while conserving and improving the existing ways, will lay out new roads, streets, or boulevards in such directions that the aspect of the homes to be built on them shall be the best obtainable. By laying hold of any existing beauty spot or piece of vegetation from a few blades of grass and a gorse bush to a noble tree with a century's growth and incorporating them in the lay-out will certainly increase the value of the site.

The appeal to the speculative builder, it is to be hoped, will have its effect. It should be possible to demonstrate to him that a little variety in planning would be in his interest, and that in this way he may continue to provide some of, if not all, the homes of the people. It is certain that many of the local authorities will not undertake the work unless under compulsion. The "economic rent" question will be an endless bone of contention, and nothing should be done to prevent the speculative builder coming to do his part under proper control, not by too repressive by-laws, but by well-considered, reasonable clauses in the schemes.

COST.

In pre-war times delay in taking up schemes was often caused by exaggerated ideas of the cost of the work or the large amount of labour involved in the preparation. To some extent these objections have been removed by the amended procedure regulations issued in February, 1914. In addition, the authorities with schemes in hand are proving, and the fact is generally becoming known, that the work is not so costly or difficult as at first supposed. The schemes which have been prepared are not landing their promoters into the payment of large sums for compensation, and this, combined with the fact that there is a possibility of betterment being claimable where costs of works are incurred, is quite an inducement to authorities to proceed with schemes.

The compulsory clauses in Part I. of the Act, which placed on the authorities responsibilities that when properly administered became costly items of expendi-

* Extracts from Presidential Address to the Town Planning Institute.

ture to the owners of the property, brought the Act generally into disrepute and militated against the adoption of town planning clauses in Part II.

Much disappointment no doubt exists that so many of the schemes which are now being prepared are but developments providing a few new routes from town to town and widenings and improvements of existing streets around towns.

The towns themselves being already built up, with their shopping, pleasure and civic centres complete, and fully meeting the requirements of the population, in which the members of the local authorities are all financially interested, it is not to be expected that any countenance will be given to schemes providing new centres, and thus dividing up the business and consequently reducing the value of the existing centres. This state of affairs will check what the authorities call ambitious schemes involving expenditure to be saddled on the ratepayers and owners of existing property, which at the present time is considered sufficient for the purpose. There is thus no scope for development which would provide sites for important buildings in the majority of schemes.

OBJECT OF SCHEMES.

It has to be remembered that the area of the schemes now being prepared averages about 1,500 acres, and consists generally of the only unbuilt-on land in the areas of the local authorities, commencing at the limit of and surrounding acres of sameness in varying degress of density and ugliness, and it is to prevent this unbuilt-on land lapsing into the same condition of sameness, density, and ugliness that the schemes are being prepared, and here, midst the disappointment and discouragement, are the hopeful signs in that there is ample room for making a scheme which shall be to the lasting good of the district. The old, crooked, narrow ways out into the surrounding country can be turned into boulevards—in miniature perhaps—but still with grass and tree-lined margins with good, wide forecourts, in which respect there is generally no difficulty with the landowner, who, after the number of houses per acre is fixed, has nothing to lose and everything to gain by setting his houses well back from the road, with all the present-day annoyances likely to arise from too close a proximity to a great highway.

In other respects opportunities occur for definitely fixing both private and public open spaces to the advantage of both the owner and the general public—but here it is to be feared that many of the local authorities will refuse the burden of their upkeep, and that many lost opportunities may occur—that allocation of areas for business, manufacturing and residential districts by arrangements with the owners must work in their interests.

Provision for railway sidings and where opportunities occur for water-carriage—of wharves, and in connection with these roads of ample widths and easy gradients providing communication between sidings and wharves with business premises, are all proper to a scheme, and in many cases are being included.

The revolution that the clauses of a scheme may be expected to work in smoothing the difficulties which the cast-iron rules of the by-laws insist upon will be a great element for good by allowing concessions in roadmaking, changes in building materials, and in the provision for combined drains in place of every house having its own separate connection with the sewer as is now necessary owing to the state of the law. It will give the landowner and builder financial consideration which will compensate him for the additional area of ground taken by the dwelling-house. Clauses regulating the elevations may, to a still further extent, be expected to assist the landowner and builder desirous of carrying out work on satisfactory lines.

The possibility of building works proceeding immediately after the war, and as to how the increased cost of materials and labour is to be met, will present great difficulties. The rise in the price of every item is very serious at the present time. Timber is quite 100 per cent, iron and steel about 75 per cent higher in cost, and there are very few items which have not advanced 20 per cent, probably the average being in excess of 30 per cent. There is no hope that these prices will be at once reduced, and the man is very optimistic who expects them ever to reach the level of pre-war times. This will, of course, retard the progress of work, and with working-class dwellings so much needed will set up problems which will require considerable ingenuity to overcome. Whatever is attempted, it is to be hoped that a hard-and-fast standardised type of reinforced-concrete building, which in some quarters it is urged will meet the difficulty and bring the cost to pre-war limits, shall not be adopted and made universal.

It is not too much to hope that all local authorities will wake up to the really disastrous effects which overcrowding has, and that they will take steps on the same lines, keeping steadily before them such improvements as will clear out the insanitary, unhealthy warrens which have been allowed to be constructed. Perhaps a Parliament alive to its duties will one day declare that the creators and owners have no vested interest, and that in what are now densely populated slums some green and open spots may appear.

RURAL COUNCILLOR AND SURVEYOR.

"UNCALLED-FOR INSINUATION."

An alleged encroachment on the highway at Bourne House, Shadforth, on the part of Councillor T. M. Oliver, who, it was alleged, used the ground as a store yard for agricultural implements, &c., was before the Highways Committee of the Durham Rural District Council on Thursday of last week.

The matter (says the *Auckland Chronicle*) was broached by Mr. Oliver himself, who, on a notice of motion, moved that the resolution ordering the removal of the implements, &c., should be rescinded.

At the same time a report on the matter was presented by Mr. G. Gregson (the surveyor).

At the previous meeting, said the surveyor, Mr. Oliver inferred that the matter had been brought forward entirely through spite, and as it was brought before the committee by him (the surveyor), it might naturally be inferred that the alleged spite was on his part, or that he had been influenced by some other person in making the report. That insinuation was quite uncalled for, for he had never at any time during his thirty-six years as surveyor to the council either made a report through spite or allowed animosity on the part of anyone else to influence him in carrying out his duties. What he reported was unquestionably an unlawful encroachment on public ground and a breach of the Highway Acts, and as such he was quite justified in reporting it after having repeatedly asked Mr. Oliver to discontinue the practice without effect. Prior to the piece of ground being taken possession of by Mr. Oliver, added the surveyor, it was used by the council as a depot for road stones, and would again be required for that purpose.

Before the motion was submitted by Councillor Oliver, the Rev. F. W. Glyn appealed to him to withdraw it.

Councillor Oliver said he was willing to withdraw the motion if the minute was not to be strictly enforced and no proceedings were taken if the implements were not removed.

The clerk (Mr. J. Chambers) replied that it was no use passing minutes if they were not to be adhered to.

Mr. Oliver thereupon submitted the motion for the rescinding of the previous resolution, declaring that his allegation of spite had not been directed against the surveyor.

The motion found no seconder, and accordingly fell through.

Pudlo.—New refrigerator works and a large reservoir with a capacity of 1,000,000 gallons have been constructed at Wyndham, Australia, for the Australian Government. We understand the reservoir was rendered with Pudloed cement to ensure its being perfectly watertight.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ENGINEER-IN-CHARGE.—October 14th.—Guildford Town Council. 50s. per week, with house rent and rates.—The Borough Surveyor.

INSPECTOR OF NUISANCES. — October 14th. — Sowerby Bridge Urban District Council. £100 per annum. — Mr. L. Rhodes, clerk, Commercial Bank-chambers, Halifax.

The Surveyor

And Municipal and County Engineer.

Vol. L. OCTOBER 20, 1916. No. 1,292.

Minutes of Proceedings.

Gas and Electricity Supply.

Under the stress of war conditions many things which formerly appeared impossible have been proved to be feasible, and every question is now approached from a greatly altered point of view. Competition between members of allied and rival industries has largely given way to a spirit of co-operation and support, not only in connection with the production of munitions of war where the new conditions are most obviously manifest, but also in directions which appear, on the surface at least, to be remote from military considerations. The public supply of those inveterate foes gas and electricity is a case in point. Up to the outbreak of war the rivalry between these commodities was constantly growing in intensity, and strenuous efforts were exerted on both sides to gain advantage; now the battle rages no longer, except in friendly fashion, and there are even signs that a *rapprochement* may be effected between them in a not distant future. The principal factor which has conduced to this result is the necessity of conserving the national resources in the shape of fuel, and turning them to better advantage than at present, while the embargo laid by the Government upon new capital expenditure on works unconnected with the production of munitions has had a share in the result. The war has compelled us to think seriously about many things which we were previously content to let be, and it is now fully realised that our priceless stores of coal are being squandered recklessly and irretrievably by their combustion without recovery of the valuable by-products, which form the raw materials of numerous industries ranging from photography and pharmacy to agriculture and the manufacture of high explosives. In this respect the gas supply industry is guiltless, for the recovery and sale of the by-products resulting from the manufacture of illuminating gas have for many years formed the principal source of revenue of most of these undertakings. But the coke burners, and electricity works which obtain their energy from coal, are great sinners, and, while the former are mending their ways, with profit to themselves and to the nation, the latter with hardly a single exception remain unregenerate spendthrifts.

Some years ago there was a strong tendency in electrical circles to adopt internal-combustion engines as prime movers, and a notable installation of gas engines was laid down at Accrington, with a considerable measure of success. The Johannesburg fiasco, however, damped the enthusiasm of the advocates of gas plant, and the rapid development of the highly efficient steam turbine finally extinguished their hopes. Obviously, by producing gas on a large scale for motive power, the installation of the elaborate and costly plant required for by-product recovery is brought within the scope of practical commercial politics, but the failure of the gas engine to "make good" and the low price of coal have militated against the adoption of this course by electricity supply authorities. However, there is an alternative to the use of gas engines; gas can be burnt efficiently under boilers, particularly if the latest scientific methods are employed, and the steam thus generated may be used to drive turbines. Moreover, the cost of coal has increased enormously, and the Government are pressing upon supply authorities the imperative necessity of economy in its use. The conditions are therefore most favourable to the reconsideration of the problem of utilising coal to better advantage than by burning it under boilers. The question naturally arises, Why should not the gas-works supply gas to the electricity works for the generation of steam? The answer is that, under their Acts, the former have to manufacture gas of a certain illuminating power, which necessitates the carbonisation of coal at a high temperature and involves the adoption of plant and methods which are incompatible with the production of cheap gas suitable for power production. The question has, in fact, been carefully studied, but the great obstacle to progress in this direction was the prescription of illuminating power. Recently, however, this standard has been waived by Parliament, and the door is open, or at least is opening, to the production of gas of high thermal value at a low price, quite suitable for use with incandescent mantles for lighting and for the production of motive power either by way of the boiler or the gas engine. Moreover, by carbonising the coal at a lower temperature the resulting coke is of a quality suitable for burning in open fire-grates, and as it gives off no smoke or tarry matter the use of this coal as fuel will go far to solve the smoke problem in our cities. Progress is necessarily slow at present, but the question is thoroughly alive, and in fact experiments are in progress in connection with two important electrical undertakings—that of the Brighton Corporation, and that of the Yorkshire Power Company—with a view to treating the coal in this way and recovering the by-products. That the movement will gain strength cannot be doubted, for there is nothing uncertain or problematical about the matter—only the controlling conditions have hitherto been unfavourable to this important advance.

There is also another aspect of the question which is attracting attention—the advisability or otherwise of supplying both gas and electricity from one joint installation. It will be seen that important advantages would accrue from such a

system. Economies could be effected in administration as well as in production and distribution to the benefit of the consumer, and the utmost possible use could be made of the fuel. While electrical men have not yet taken steps towards supplying gas to the public, many gas suppliers are contemplating the addition of electricity supply to their activities, and some are already supplying both commodities. In the Scottish town of Alloa, for instance, the municipal gas undertaking has for some years been responsible for the supply of electricity, and in a paper recently read before the North British Association of Gas Managers, and noted in our issue of September 8th last, the manager, Mr. J. W. Napier, gave an account of the progress of the joint undertaking. Mr. Napier limited his proposals to towns with a population not exceeding 20,000 persons, but there appears to be no insuperable objection to such a combination in larger centres. This is not the only example of a successful joint undertaking, and it seems likely that important developments in this direction will take place before long.

* * *

An Improved Metropolis.

It has been known for some time that, under the auspices of the London Society, a comprehensive plan for the development of Greater London—not piecemeal, but considered as a single entity—has been in course of preparation. The scheme was undertaken with the dual object of providing congenial and useful work for architects and surveyors whose businesses have been ruined by the war, and of furthering the general purpose of the society to secure a better and healthier Metropolis. We learn from the *Morning Post* that the scheme is now complete, and although at present it has no official sanction, the promoters have good ground for hoping that this may be obtained in due course. It is pointed out that local improvements, of which there have been many in recent years, are all open to the objection that they are planned solely with a view to local advantage, and usually without reference to the needs of London as a whole. The present scheme, on the other hand, regards the Metropolitan area as a vast unit, and seeks to indicate the lines upon which its development may be carried out with the greatest advantage to the community. As a matter of organisation London was divided up into five sections, and for each of these a committee was appointed. These committees have been at work for two years, and have now completed their task, which embraces the whole of Greater London within a radius of 15 or 20 miles from the centre.

Through the courtesy of Sir Aston Webb, who has long worked to bring about a larger outlook and has taken an influential part in the present movement, our contemporary is able to indicate some of the most interesting of the proposals now definitely charted on a large scale map of 18 ft. by 15 ft. Copies of this map will soon be available for exhibition and study in town halls and public institutions, so that familiarity with a great design may counteract antagonistic local enterprises and may establish it as an ideal for borough councils and town planning committees to live up to. The principal feature that strikes the eye on looking at this map of London as it is to be is that the new city is completely encircled by a ring of parks and woodlands, meadows and gardens extending from Epping Forest on the east to Richmond and Bushey Park on the west. Naturally, too, the preparation of the scheme has involved the attempt to plan an improved system of arterial roads, one of the most interesting features of which is the joining up of the western main road with Cromwell-road, South Kensington, which at present comes to a dead end. This road is to be relieved by a by-pass or loop at Brentford, for which the Middlesex County Council has already secured the land, and thereby a most dangerous spot for vehicles, as well as for foot passengers crossing the narrow thoroughfare, will be freed from congestion. Another arterial road is planned to pass through Acton further north, the existing road, as far as possible rendered suitable by widening, being continued across Wormwood Scrubs and through Notting Hill and Bayswater. In the south a by-pass from the great southern road is to run through Croydon, where the existing congestion renders it very needful, and there is also projected an improved arterial road in the south-west with a by-pass through Sutton, while a new eastern road will facilitate traffic to the docks.

The scheme also deals with the Charing Cross improvement, which has been the subject of so much public discussion of late, but so far a decision has not been reached with regard to alternative designs for the new bridge. In preparing this comprehensive scheme the London Society have accomplished an excellent piece of work, which—even if it cannot be carried into execution by one authority—will serve to stimulate the imagination of local authorities and lead them to view their local requirements as part of a great whole.

* * *

Town Planning and Business.

After all that has been said and written with regard to town planning as a business proposition for the landowner, we were rather surprised to have brought to our notice some articles by "Architect" that have appeared recently in the *Liverpool Courier* based upon the discovery that "idealism and sound business do not merge." The articles are written frankly with the object of justifying the speculative builder, but we doubt whether to achieve this end it was necessary for the writer to attack municipal enterprise (including the "town-planned house," whatever that may mean), and every other form of effort to meet the admitted shortage of working-class dwellings. It is no doubt true, as "Architect" points out, that about 97 per cent of the total number of houses in this country have been provided by private enterprise, but it is equally true that in many districts private enterprise has utterly failed to meet the demand for new dwellings, with the result that serious overcrowding has taken place. "Architect" advances several reasons why the property of the speculative builder is in so much demand. "It has been designed and constructed with a view to pleasing the tenant and suiting his tastes. And here lies the difference between a house put up by the private builder and a dwelling in a garden suburb. The town-planned house is originally supposed to be laid out for the benefit of the artisan, but that individual finds he is asked to pay for a house with meagre accommodation, a rental that he can't afford, and which is in excess of what he would have to pay for a house which affords the accommodation he requires. The advantage offered for the extra rent in the town-planned house is a piece of land which the tenant has probably neither the time, inclination, nor money to keep in that flourishing condition which is desired. The property put up by the private builder is economically schemed, from the tenant's point of view, and is therefore in greater demand." But if there is such a demand as alleged, why is it not supplied? The fact is that the supply often breaks down, and, as we have always contended, it is here that the legitimate function of the municipality begins. The root of the whole matter is that—to use the phrase of Sir James Crichton-Browne, which we quoted recently—"every civilised man is entitled as of right to a clean wigwam," and this at a rent which he can afford to pay. Experience has shown that to meet this demand there is plenty of room for the efforts of speculative builder, public utility society, and municipality, and that even when all

are doing their utmost some form of State assistance will be necessary to maintain the principle of the economic rent.

* * *

Electric Haulage.

On another page in this issue will be found a report of great interest by Mr. S. L. Pearce, the chief engineer of the Manchester electricity department, on the results of a trial use of an electric vehicle in place of horse haulage in connection with the work under his control. The trial has lasted since the end of March, and the report is only concerned with the actual results obtained, no attempt being made to make out an artificial case for the continued use of the electric type of vehicle. On the contrary, Mr. Pearce states that he entered upon the trial in a somewhat sceptical spirit, but the result has been such as to lead him to recommend his committee to retain the electric vehicle, on the ground that in the light of the experience gained he has little doubt that electric lorries can with advantage be used for other branches of the carting work of the department. In considering the possibility of replacing horse haulage by any form of mechanical traction, it is evident that calculations must be based on the assumption of a complete re-organisation of work to meet the new conditions. For example, if an electric lorry were merely to replace and do the equivalent work of a single horse lorry, it would certainly not compare favourably, owing to the higher standing charges and additional running costs. On the other hand, Mr. Pearce shows that with a rearrangement of work so as to make the use of the electric vehicle as nearly continuous as possible, a considerable saving can be effected.

While dealing with the subject of mechanical traction, we may mention that a valued correspondent has drawn our attention to the frequency with which he receives from other surveyors requests for answers to a series of questions on this matter. While he, in common with other members of the profession, is always ready to assist others by giving information in this way, he points out that to reply to some of the questions he has received would mean taking members of an already depleted staff off their regular work to prepare elaborate tables of figures. Detailed reports with comparative figures have already been prepared by several eminent surveyors, and these have been published in our columns. Our correspondent suggests that much time and unnecessary labour would be saved if, before deciding to circularise others for information, surveyors would make full use of these reports which are already open to their inspection.

* * *

Economy in the Use of Coal.

Mr. R. A. Chattock, city electrical engineer to the Birmingham Corporation, recently delivered an address as president to the Birmingham Association of Mechanical Engineers, in the course of which he vigorously advocated the adoption of more economical methods of utilising coal by gasifying it and recovering the valuable by-products, without, however, touching upon the question of supplying gas to consumers. In Mr. Chattock's view it is desirable to deal with the coal as near the great coal centres as possible, and to generate electrical energy for transmission to all parts. As the use of the gas alone for raising steam would involve the handling of an enormous quantity of coal, and the production of an excessive amount of coke, it would be necessary to consume some of the latter under boilers, thus solving both difficulties. An installation of this kind, with complete recovery plant, would occupy an enormously greater area than the ordinary electric generating station, and large quantities of water for cooling purposes would be required, but the result would be, in addition to the conservation of our coal and the elimination of smoke from the atmosphere, the supply of energy to manufacturers and other users at extremely low prices, and a great relief to the congestion of traffic on the railways. So important does the erection of these "super-stations" appear to Mr. Chattock, that he would not hesitate to advocate the adoption of some form of compulsion by the Government to bring it about, either in the form of State control of the coal supply, or indirectly by putting a tax on all users of coal who consume it in an uneconomical manner, the tax being utilised for financing the scheme. Seven years ago Dr. Ferranti, in a famous address to the Institution of Electrical Engineers, put forward similar views regarding the national importance of an exceedingly cheap supply of electricity, and it is interesting to observe how the matter is taking shape in the minds of the leaders of the electrical industry at the present time. Actual results are already beginning to be recorded.

* * *

The Dublin Reconstruction Agreement.

The Bill for the rebuilding of Dublin has now been satisfactorily drafted between the parties concerned, the Dublin Corporation and the Property Losses Association, and will be presented to the House of Commons as a practically agreed measure. The understanding reached covers all questions of principle, and it is anticipated that the working out of the details will present no points of real difficulty. Provisions have been inserted dealing with the opening of new streets and the widening and reconstruction of streets. The widening of streets other than North Earl-street, which was partially destroyed, is abandoned, with the exception of the possible adjustment of Henry-street and the possible widening of Cole's-lane. Where the Dublin Corporation propose to take over any site space the site shall only be taken over under the Land Clauses Act as regards compensation. With respect to the powers of the corporation to grant loans for rebuilding it is provided that the grants shall be mandatory and not permissive. It is likewise provided that the plans of reconstruction shall deal exclusively with the exterior frontage, and it is further tentatively agreed that there shall be a differential valuation in regard to premises to be re-erected. This latter point obviously involves a question of public policy, but it is hoped that it will be settled satisfactorily with the representatives of the Government. The term for the repayment of the loans to owners for rebuilding has been fixed at sixty years, thus providing for a reduction in the annual repayment of principal and interest in the nature of a sinking fund. The Bill contains the elements of a workable understanding between all parties, and the Corporation of Dublin are to be congratulated upon the fact that, while they have brought reconstruction measurably nearer than it was a month ago, they have achieved this desired objective upon lines that are reconciling and reassuring.

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Printing of Annual Reports.

The latest annual report of Mr. C. H. Cooper, the borough engineer and surveyor of Wimbledon, is a striking example of municipal war-time economy. A booklet of some forty-eight pages, it has been printed and bound entirely by the department of which Mr. Cooper is chief, and proves that that gentleman is determined to make the fullest use of a duplicating apparatus which evidently forms part of his office equipment. The production, which, by the way, includes three folded inset plates, is, while not altogether free from blemishes, quite a creditable one. At the same time it would be interesting to have some idea as to the saving which has resulted from the experiment.

Electric Vehicle Trial at Manchester.

By S. L. PEARCE, M.INST.C.E., M.I.L.E., M.I.MECH.E., F.AMER.I.E.E., Chief Engineer, Manchester Corporation Electricity Department.

[In the following report, prepared for the information of the Manchester Corporation Electricity Committee, Mr. Pearce deals with the trial, conducted by the Testing Department under the general direction of the superintendent, Mr. H. A. Ratcliff, of an electric vehicle which has now been purchased - in place of horse haulage in connection with the work of his department. The lorry is a standard 1-ton vehicle, the chassis of which was built by the General Vehicle Company, and supplied by Messrs. Drake & Gorham, Limited. It is equipped with a 3-h.p. motor (capable of 200 per cent overload for short periods) and a standard Edison battery, and has been actively employed in the service of the department since the end of March last.]

The report deals with the subject on the basis of the actual results obtained, and no attempt has been made to work up a case for the electric vehicle. Indeed, so far as personal considerations are concerned, I have been somewhat sceptical as to the possibility of an electrical lorry being able to compete with our existing contract carting arrangements, and also as to the claims made on behalf of the former.

HORSE-CARTING CONDITIONS.

Light lorries have been ordered from the contractors as required by the several departments concerned. Payment has been at a flat rate on a time basis—either so much for the day, or for shorter periods than a day at so much per hour.

Two years ago the charge for a light lorry and driver was 1s. 3d. per hour. Last year it was 1s. 4d., and owing to war conditions the charge has now been increased to 1s. 6d. per hour for the current year.

It is unlikely that the present price will be maintained for many years, but it is equally unlikely that the cost will ever drop back to 1s. 3d. per hour, and I have therefore taken a figure of 1s. 4d. for the purpose of comparison.

TEST CONDITIONS.

It was obvious that if the electric lorry was merely to replace and do the equivalent work of a horse-lorry it would certainly not compare favourably, owing to the higher standing charges and the additional running costs. Consequently it has been necessary to reorganise the carting arrangements to a very considerable extent; but it is only fair to say that such reorganisation was only possible as a result of the following conditions—viz.:—

(*a*) The electric lorry was under our entire control, and we were consequently independent of outside carting contractors.

(*b*) The electric lorry, being purely a machine, could be worked to a very much greater extent than a horse, which is merely flesh and blood, and therefore has to be treated accordingly. For instance—a horse must be allowed one hour and a-half in the middle of the day for baiting; whereas, if the battery is sufficiently charged, the electric vehicle may, if necessary, be run without a break by changing drivers, as has actually been done on one or two occasions.

(*c*) The assistance and co-operation of the several departments concerned—viz., sub-stations, mains, and stores.

Briefly, the organisation has consisted in arranging the carting of the several departments so as to give as nearly as possible continuous employment for the electric vehicle, and also whenever possible reducing the number of separate journeys by combining two or more departmental carting jobs in one round journey.

DRIVING ARRANGEMENTS.

The employment of a special driver appeared to be an undesirable and, moreover, an expensive arrangement. Two very steady and competent fitter's labourers were therefore trained for the work.

This arrangement possesses the following advantages:—

(*a*) With two drivers available there is less risk of the work being held up, and if necessary time may be saved by changing drivers in the middle of the day.

(*b*) When standing for any legitimate reason in the polygon yard, the driver's attendance is not always necessary, and he can therefore be employed on other work, thus reducing the standing charges considerably.

(*c*) When loading or unloading at the motor shop the driver becomes a fitter's labourer, and books his time accordingly, with a corresponding reduction in the standing charges.

(*d*) On many of the motor department carting jobs it is possible for one man to combine the duties of driver and fitter's mate, and the effect of this arrangement will in such cases reduce the standing charges below the corresponding cost for a horse-lorry.

WORKING COST OF ELECTRIC LORRY.

I have calculated the costs on a very liberal basis, and therefore they cannot be considered to favour unduly the electric lorry.

The figures arrived at are—

Standing charges	1s. per hour.
Running costs	2d. per mile.
Driver	7d. per hour (during the time he is actually employed with the lorry).

The following details show how the costs have been arrived at:—

(*a*) *Standing Costs.*

The standing charges have been calculated on a basis of 2,500 working hours per annum—*i.e.*, fifty hours per week for fifty weeks in the year.

This is a very conservative estimate, and makes ample allowances for Bank Holidays and occasional stoppages for overhauling and repairs.

The "life" of the chassis and body has been taken at ten years, and written down accordingly at 8¾ per cent per annum.

The makers state that the battery will last for at least ten years, or alternatively for 100,000 miles.

The guarantee, however, is only for four years, and I have therefore taken five years as a reasonably safe estimate of the working "life" of the battery, and written it down accordingly at 18¾ per cent per annum.

The possible scrap value of the battery after five years' "life" has been ignored.

In view of the present state of the money market, interest on the full capital outlay has been allowed at 4½ per cent. This should be a reasonable allowance, as it is to be hoped that the war will be over and the money market somewhat more normal before the "life" of the vehicle has expired.

The actual capital charges are therefore as follows:—

	£	s.	d.
Outlay on chassis, £355, less 5 per cent ...	337	5	0
,, battery, £280, less 5 per cent ...	266	0	0
,, body	45	0	0
,, tyres	25	0	0
,, filler	2	10	0
	£675	15	0
	£	s.	d.
4½ per cent on £675 15s.	30	8	2
8¾ per cent on £384 15s.	33	13	4
18¾ per cent on £266	49	17	6
	£113	19	0
Insurance	10	0	0
Two drivers' licences at 5s. each ...	10	0	0
	£124	9	0

$\frac{£124\ 9s.}{2,500}$ = 11·95d. or, say, 1s. per hour on a basis of 2,500 hours per annum.

If the interest rate be taken at 5 per cent the figure becomes 12·27d.

In addition, there is the wages of the driver at 7d. per hour; but this is hardly a true standing charge, for the reasons given above.

(*b*) *Running Costs.*

The load is an "off peak" one, and does not cost

the department being than one-third of a penny per unit; but in order to cover small incidental expenses occasioned by overtime and other charges, I have taken the cost of current at ½d. per unit.

The vehicle normally requires about 6·5 ampère-hours per mile, which corresponds to about 0·7 kilowatt-hours per mile; but as the efficiency of the motor-generator used for charging the vehicle is only about 70 per cent, the actual consumption per mile is approximately one kilowatt-hour.

The cost of tyres has been based on a "life" of 12,000 miles; and repairs and upkeep of vehicle and battery have been taken at 1d. per mile, which is well in excess of the makers' allowance of 0·6d. per mile.

Tyres 12,000 miles at £25 the set $\frac{25 \quad 24 \cdot 1}{12{,}000} = 0{\cdot}5$d. per mile.

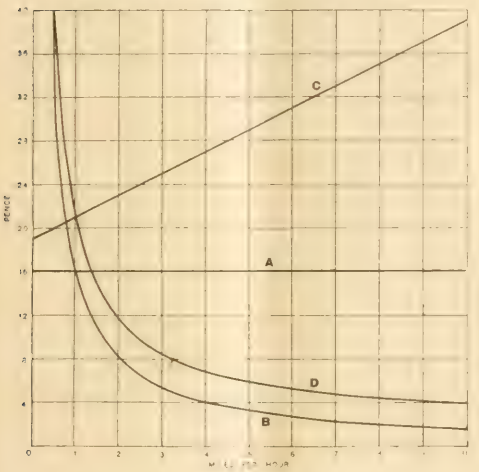
Total running costs per mile.

Current at ½d. per unit	... ...	0·5d.
Tyres ...	...	0·5d.
Repairs and upkeep ...	...	1·0d.
		2·0d

COMPARISON OF COSTS.

From the above results the accompanying curves have been drawn, and they enable the relative costs for any condition of speed to be seen at a glance.

The curves show



A—The cost per hour for horse lorry and driver.
B—The cost per mile for horse lorry and driver.
C—The cost per hour for electric lorry and driver.
D—The cost per mile for electric lorry and driver.

All the curves have been drawn to a common base of "miles per hour."

The two most noticeable features are—

(*a*) The cost of the horse lorry per hour is naturally independent of the mileage.

(*b*) The standing cost of the electric is only 3d. more than for the horse lorry, and is actually 4d. less if the driver is not in attendance.

Obviously, under any running condition the cost per hour of the electric is greater than that of the horse vehicle, and consequently comparable results can only be obtained by getting more work out of the electric in the same time—*i.e.*, by increasing the average miles per hour.

It has been found that 2 miles per hour is an average figure for an ordinary horse lorry. This figure is not, of course, the actual speed on the road, but includes all loading time and other stoppages. For the ordinary carting day of nine hours this gives an average daily mileage of 18, which I consider to be a very reasonable estimate. Further, the figure of 2 miles per hour was arrived at as an average for the mains, sub-stations, and testing departments' carting after an analysis of several carting vouchers.

Before these trials were conducted I was of the opinion that an electric lorry would only be worth consideration if it could be shown to be capable of doing the work of one and a-half horse lorries. In this connection it is interesting to note that the Midland Railway Company are going in extensively for electric vans on the strength of their experience that one electric is equal to one and a-half horse-vans.

I think the figures of the actual operating data [which appear as an appendix to Mr. Pearce's report, and which cover a period of four weeks, ending May 6th last] plainly show that the electric lorry is certainly the equivalent of at least one and a-half horse lorries, work for work, both on the total average daily mileage and also on the average miles per hour.

Referring to the curves, it is seen that at 2 miles per hour the horse lorry costs 8d. per mile, and a horizontal line drawn through this point cuts the electric curve at 3·16 miles per hour, a condition which the tests have proved to be practically fulfilled.

Work for work, therefore, the electric is practically the equivalent of one and a-half horse lorries; but further than this, owing to the organising of the carting rendered possible by the use of a mechanical vehicle, each journey undertaken has represented the carting of 1·6 departments, and therefore the total work done by the electric is the equivalent of that done by $1{\cdot}5 \times 1{\cdot}6 = 2{\cdot}4$, or, say, two horse lorries. [A second appendix to the report gives an analysis of the work done during the four weeks ended June 3rd last. A comparison with the previous schedule shows an appreciable improvement in the results obtained.]

The average cost works out at 7·65d. per mile (instead of 8d.), or $188{\cdot}1 \times 7{\cdot}65\text{d.} = £6$ per week.

Calculating on a basis of 2 miles per hour for the horse lorries, the figures [as given in the second appendix] appear to show that the electric is the equivalent of $\frac{3{\cdot}37}{2} \times 1{\cdot}61 = 2{\cdot}71$, or, say, two and a-half horse lorries.

Confirmation of this ratio is obtained from the opinions of several persons competent to judge the change in the carting conditions.

The electric lorry is variously estimated as the equivalent of from two to three horse lorries, with a preponderance of opinion in support of the higher value.

For fifty-eight hours during the four weeks ending June 3, 1916, or an average of 14·5 per week, the driver was actually working as a motor fixer's labourer. This represents a saving on the driving item of $14{\cdot}5 \times 7\text{d.} = 8\text{s. } 5\text{d.}$

The nett cost of the carting is therefore £6 − 8s. 5d. = £5 11s. 7d. for 188·1 miles, or 7·12d. per mile.

Assuming the electric to be the equivalent of two and a-half horse lorries, the amount saved per week is $2{\cdot}5 \times £3\ 6\text{s. } 8\text{d.} - £6 = £2\ 6\text{s. } 8\text{d.}$ (The figure of £3 6s. 8d. represents fifty working hours at 1s. 4d. per hour.)

This calculation makes no allowance for possible reduction in actual driving time. The amount saved in a year of fifty working weeks will therefore be £116 13s. 4d., or nearly sufficient to cover the capital charges on the electric lorry.

TOTAL COST OF ALL CARTING.

The following figures give the cost of all carting for the months named.

	£	s.	d.
January, 1916	150	4	8
February ,, ...	131	1	0
March ,, ...	158	8	2
April ,, ...	109	4	3
May ,, ...	110	16	11

Owing to the weather conditions there was a marked reduction in all the carting during the month of February. It is therefore permissible to regard the mean of the January and March costs as a reasonable average value.

The Easter holidays would reduce to some extent total carting for the month of April, and I would therefore increase the actual cost by £6.

	£	s.	d.
Average cost per month for January and March	154	6	5
Average cost per month for April and May	113	0	7
Actual reduction due to the operations of the electric lorry	£41	5	10
Average cost per month of electric lorry ...	26	0	0
Amount saved by electric lorry per month	£15	5	10

Taking the weekly cost of a horse lorry as 75s.—*i.e.*, fifty hours at 1s. 6d. per hour, or, say, £16 6s.

per month, and the electric lorry as the equivalent of two and a-half horse lorries, then the reduction on the carting account should be—

£16 6s. × 2·5 = £40 15s.

This estimated figure agrees very closely with the actual reduction obtained as above.

Were it not for the unduly inflated price of electric vehicles, and more particularly of those fitted with Edison batteries, very much better working costs than those given above could be obtained.

SPEED.

The first impression of the speed is that it is very low, and it is undoubtedly lower on the average than the makers claim. As the bulk of our carting is in the city area, however, it is at least questionable whether a higher average speed would be much of an advantage. On hills there is certainly room for improvement, but this could only be obtained at the expense of a larger battery and an unnecessarily high and undesirable speed on the level.

The very low speed on hills is the natural result of the characteristic speed torque curve of the series motor, and is further accentuated by the comparatively high internal resistance of the Edison battery.

Probably this is one reason why lead batteries are frequently preferred for vehicle work, although personally I consider that any gain in this respect is more than counterbalanced by the objections attaching to the use of sulphuric acid on vehicles.

The average speed is higher than can be maintained by a horse, and on the level is probably as good as that obtained with a steam lorry; but although better than a horse, it cannot equal a petrol vehicle on hills. Our class of work, however, is not suitable for a petrol vehicle, but is to some extent ideal for an electric.

On average roads, and with average loads, the average speed is about 9 to 11 miles per hour, and may under exceptional conditions reach 12 miles per hour. On hilly roads the average speed is 7 to 9 miles per hour, but less if the hills are exceptionally steep.

On a recent journey with the vehicle fully loaded (1 ton) and two persons in the cab, the average speed between the polygon and Cheetham-hill sub-station *via* Cross-street and Cheetham Hill-road was 7·6 miles per hour, and on the complete circular journey, *via* Heaton Park, Rhodes, Middleton, Alkrington, Blackley, Harpurhey, and Ancoats the average speed was 8·3 miles per hour.

Ascending the steep hill from Blackley to Harpurhey, by the side of Boggart Hole Clough, the speed fell to a minimum of 4·5 miles per hour.

It might be thought that on hilly roads the speed on down grades would balance the speed on up grades, and so give the same average speed as on the level. This, however, is not the case in practice, because it would necessitate running down hill at a speed higher than is desirable from considerations of safety, for when the vehicle is fully loaded the total weight is 3 tons, and obviously a load of this description must be kept well in hand on the down grades at any rate if there is much traffic about.

On a recent trial run 16 miles per hour was obtained on a down grade in Middleton-road, but the road was clear and there were no side roads. Such a speed would, as a rule, be quite out of the question, and I should never expect the drivers to exceed 12 miles per hour under any conditions.

The apparently low speed has not prevented our making an average of 30 miles per day, and a maximum on one occasion of 50 miles in the day.

It is questionable whether the railway companies' petrol-driven parcels vans average more than 35 miles per day.

GENERAL CONCLUSIONS.

As a result of these extended trials I recommend the committee to retain the electric vehicle. Further, I have little doubt—in the light of the experience gained that electric lorries can be advantageously used for other branches of the department's carting work in preference to horse-drawn vehicles.

Malvern's Population. In our issue of September 22nd, in referring to the scheme of the British De Tinning Company, the population of Malvern was given as 8,000. This, Mr. Wm. O. Thorp, the engineer and surveyor to the council, points out, was the figure in 1891. The present population is estimated at 18,500.

MUNICIPAL ENGINEERING WORK AT WIMBLEDON.

Wimbledon, according to the report of the borough engineer and surveyor, Mr. C. H. Cooper, M.INST.C.E., for the year ended March 31, 1915, has an area of 3,320 acres, an estimated population of 58,671, and a rateable value (general district rate) of £445,420.

In regard to highways, Mr. Cooper states that the number of streets repairable by the town council at the end of the year in question was 236, with an aggregate length of 51·68 miles, including 2·56 miles of main roads. During the year 1·68 miles of private streets were added.

With the exception of 3,456 yds. of Roadamant 1 in. thick, laid in High-street in August, 1912, no asphalt surfacing was laid in the borough until May, 1914, when 6,426 yds. of Duromac, 3 in. thick, was laid in Hartfield-road in order to allow this road to carry the motor-'bus traffic, which had destroyed the surface and caused such vibration that serious complaints were received from residents.

The price paid for this surfacing was 5s. 6d. per yard super.

For several years past the motor-'bus traffic had rendered Parkside almost impassable during the late winter and early spring, and in order to obviate this inconvenience the road was surfaced with a similar material to that used in Hartfield-road. The total area laid was 18,068 yds. super., and with the exception of about 165 yds. super., the paving has shown no signs of deterioration.

ROAD MAINTENANCE COST.

The report states that the maintenance of carriageways cost £158·61 per mile.

REFUSE COLLECTION.

During the period under review collections of house refuse were made once a week, except during the months of June, July and August, when the work was done twice weekly.

SEWAGE DISPOSAL.

The volume of sewage treated at the disposal works is estimated at 1,345,932,000 gallons, and the cost of treatment was £3,026, equivalent to a rate of 1·73d. in the £. The amount of sludge cake produced during the year was 6,326 tons, incurring a cost of £1,099.

In July, 1914, the corporation entered into a contract with the S.O.S., Limited, to take for ten years from that date the sludge, the firm depositing £500 to pay all penalties and to indemnify the corporation for any loss they may incur, and to pay a rent of £50 per annum for the site of their works, having an area of 38 acres. Under this agreement the corporation have, so far, saved £115, the cost of handling sludge cake.

Maintenance of Railway Bridge Roads.—Essex County Council have agreed to enter into an undertaking to maintain the roads over bridges belonging to the Midland Railway Company, in cases where the liability for upkeep at present rests with the company, at the same standard as now existing for ten years, the annual payment for the first five years to be £70, and for the second five years to be £35.

A Record Water Consumption.—In Philadelphia the consumption of water is about 180 gallons per head per day. In one week recently approximately 2,338,000,000 gallons were used, an average of 334,000,000 gallons daily. Having regard to these figures, we are not surprised to learn that the city is threatened with a water famine. The filtration plant, which cost the city £7,000,000, is inadequate, and the Chief of the Bureau of Water is preaching economy in the use of water. In many buildings and houses, especially in South Philadelphia, there is no water for hours daily.

Glasgow Cleansing Department.—The report by the superintendent of the Glasgow cleansing department for 1915-16 shows that the nett cost of the year's operations, excluding expenditure on private streets and courts, was £162,219, an increase compared with the previous year of £7,999. The estimates prepared at the beginning of the year provided for an expenditure of £204,424, but this amount was exceeded by £755. The revenue (£42,959) showed an increase over the amount estimated of £549. The estimates anticipated a nett cost of £162,014, but the actual result shows the charge against assessment to be higher by £205.

The New Water Supply of Watford.*

By DAVID WATERHOUSE, Engineer and Surveyor to the Urban District Council.

Watford Waterworks.

With the rapid growth of Watford the necessity of carefully considering the future water supply became urgent. During summer months the water level in the wells fell very low one year reaching the extremely low point of 24 m. above the suction strainer. In addition the pumping plant was running for practically the full twenty four hours and could not be pushed further. With the waterworks in this unsatisfactory position it was quite apparent that further measures were necessary to safeguard a supply to the town.

The old works were of such a nature that they could not be suitably extended, the site was not sufficiently large to be utilised for new works, and, moreover, it was necessary that the supply to the town should be maintained during the construction of any new work.

It was possible to draw an abundant supply of water in the neighbourhood along the Colne Valley, and as there was no necessity to go further afield to find a suitable site for new works, a site adjoining the old waterworks was purchased. This site included the Watford Fields House and land, comprising about 7 acres. At a later date the council were able to obtain an adjoining piece of land of about 2 acres.

In 1903 the author submitted a report on a new water scheme for the consideration of the council. This proposal embodied a new deep well, pumping station and softening works on the Watford Fields site, a service reservoir to hold 2,000,000 gallons, situated at Merryhill, Bushey, and the necessary pumping and delivery mains, which would be connected to the existing distribution system. With this combination a constant supply of water at an increased pressure could be secured to the town which would meet double the existing demand.

After considerable delay and much discussion by the council, which continued over several years, it became necessary to submit a revised estimate for the scheme, amounting to £114,000.

This scheme was based upon a supply of 1,500,000 gallons in ten hours, and although this quantity provided for a considerable increase of population, a glance at a table showing the growth of the town, together with the fact that a considerable extension of the urban district will, in all probability, take place after the war, convinces one that it was wise to allow an ample margin. The scheme was approved.

Pending the settlement of the water scheme, it had in 1905 become necessary to augment the supply to a part of the town. Watford grew considerably in the north, and the level of this part of the district is such that sufficient pressure is not afforded by the reservoir. To meet this difficulty an electrically driven pressure pump of 35 b.h.p. was fixed on the supply main to this district, and affords it an additional head of 100 ft. The pump was arranged on a by-pass to the water main, so that the reservoir pressure could be used at night when it was quite sufficient. It has now become necessary to run this pump for sixteen hours a day from 6 a.m. to 10 p.m.

Auxiliary Works.

It was decided in 1910 to carry out certain preliminary work, which included the sinking of a 30-in. diameter borewell to a depth of 258 ft., on the site of the new works, for the purpose of testing the yield and also for use as an immediate auxiliary to the existing supply until the new scheme was completed. A compound Undertype engine, with double-acting deep well pump 28-in. stroke, 19 in. diameter, with multiple valves, was fixed, and the water pumped through a gauging chamber to waste, or into a closed well at the old waterworks.

It is not the intention to deal with this section of the work in detail, as the sinking of the borewell was very similar to the larger wells to be described. It is, however, interesting to record the results of the pumping after the plant had been started. The rest level of the water was about 20 ft. below the level of the engine-house floor, and on first commencing to pump the water-level dropped in seven minutes to the level of the suction strainer, which is about 150 ft. below floor level, the pump at this point drawing air and water. Pumping was continued for several days with no better result. Intermittent pumping was then commenced. The water was allowed to rise in the well, then pumped down with the pumps running at full speed, with the object of clearing any fissures. This probably conduced to the desired result, for after successive pumpings the water rose very rapidly in the well, and a large quantity of chalky matter passed through the pumps, followed after some days' pumping by clear water.

The water stood, while pumping, at about 68 ft. below floor level with but little fluctuation, and under test the quantity obtained was about 1,270 gallons per minute. When running at a maximum speed 1,750 gallons per minute were obtained, the water-level dropping to 100 ft. below floor level, but the test was only for a very short time.

Since the instalment of this plant it has on more than one occasion proved its necessity by keeping the town supplied when the water in the old wells dropped very low; it also proved that there is an abundant supply of water to be obtained on the site selected for the new works.

* From a paper read at a meeting of the Institution of Municipal and County Engineers held at Watford on the 7th inst.

The contractors for the borewell were Messrs. T. Docwra & Co., of London, and the contractors for the pumping plant were Messrs. J. Simpson & Co., of Newark.

PERMANENT WORKS. BOREWELLS.

In August, 1912, the permanent works were commenced. It was decided to modify the arrangement of a large well, which was the first intention, and substitute five borewells, and thus save considerably in the cost.

The strata through which the wells are sunk, with the exception of about 25 ft. of gravel on the surface, consisted wholly of chalk and flints, the latter intermixed in the chalk or in beds.

Four pumping wells (Nos. 1, 2, 3, 4), which are under the engine-house, are arranged in two pairs; they were sunk 350 ft. deep from ground level, and for a depth of 80 ft. they were lined with tubes 40 in. internal diameter, and for the remainder of the depth they were 36 in. in diameter and unlined.

The tubes forming the lining of these four wells were of cast-iron $1\frac{3}{8}$ in. thick, 9 ft. long. They were machined at each end to $\frac{7}{8}$ in. in thickness to admit of a collar or sleeve joint, and weighed after machining 2 tons 2 cwt. 1 qr. 19 lb. each. They were coated with Dr. Angus Smith's composition, excepting the machined parts, which had a coating of boiled oil. The collars forming the joints were of mild steel $\frac{1}{2}$ in. in thickness after machining and 16 in. in length. Each joint was made in red lead and screwed up with sixty-four $\frac{3}{4}$-in. countersunk steel screws. The leading tube to each well was provided with a steel cutting shoe fitted to the tube similar to the collars, but with a slight projection from the tube on the outside. All the jointing faces of the tubes, collars, and shoes were machined, and the joints made in red lead.

There is little to record about the actual boring; it was carried through by the contractors without a hitch. From about 30 ft. below the surface the boring was in water; the progress varied from 5 ft. to less than 1 ft. per day, according to the quantity and toughness of flints encountered and the depth of the work. The boring was carried out with a chisel, with the exception of a short length of very hard flint, in which a rotary tool and steel shot were used.

As there was no difficulty about the sides of the wells standing below the pilot shafts which were sunk and timbered through the surface gravel, the whole of the lined depth was sunk and the tubes afterwards jointed up one at a time and floated by means of a false bottom into position. The cutting shoe was driven well into the chalk, after which cement grout was run in to the annular space between the tubes and the chalk.

The large bored well (No. 5) which was sunk outside the pumping station was intended chiefly to provide a working shaft from which to drive headings to augment the supply should the wells under the engine-house not yield sufficient for the requirements of the town. The headings would be connected up to the wells under the engine-house, and also to the well under the auxiliary pumping station, which, as before stated, gives such an excellent yield.

The No. 5 well is 300 ft. in depth, and was bored 84 in. in diameter for a depth of 80 ft., which is lined; the remaining depth is 72 ft. in diameter.

The lining cylinders, $80\frac{1}{2}$ in. in external diameter, are 5 ft. in depth, $1\frac{1}{4}$ in. in thickness, with $1\frac{1}{2}$-in. flanges, 1-in. brackets, $1\frac{1}{4}$-in. ribs, and are bolted with $1\frac{1}{8}$ in. diameter bolts of which there are twenty-six to each joint. The joints are machine-faced and made with hemp and red lead, and the caulking space filled with rust-jointing material.

The leading cylinder is similar to the others, but is 4 ft. in depth, and provided with a cutting edge. The cylinders were jointed up on the surface, one at a time and floated down by means of a false bottom; they were then grouted up in a similar manner to the tubes.

The sinking of this well was perhaps of more interest than the others on account of its size; it is one of the comparatively few bored wells of its size in the country. The chisel used for the work comprised a mild steel riveted-up frame, having thirteen separate chisels and points, ten of which could be removed for renewal. The chalk slurry was removed from the boring by means of a grab attached to a steel rope and operated by the boring winch. The grab discharged into tip wagons, which were run to a convenient part of the site for tipping.

The contractors for the five borewells were Messrs. A. C. Potter & Co., of London.

PUMPING STATION.

The pumping station comprises an engine-house, engine-house basement, fitting shop, boiler-house, chimney shaft, coal store, superintendent's office, lavatory, and general store.

CHIMNEY SHAFT.

The chimney shaft is built on the same principle as the Custodis chimneys. It is 121 ft. in height, built circular with an octagonal base upon a reinforced-concrete bed 18 ft. square, and is lined with fire-brick for the first 40 ft. The inside diameter at the top is 5 ft.; at the bottom it is 6 ft. 3 in. inside the fire-brick lining. The bricks used in its construction are specially made, and perforated to form a key for the mortar.

The contract for the chimney shaft was carried out by the Reading Boiler Setting Company, of Reading.

PUMPING PLANT.

The main pumping plant, which has been arranged in duplicate so that there is a complete stand-by to meet every contingency, comprises two triple-expansion horizontal Worthington high-duty surface-condensing pumping engines, each set being equipped with low-lift (borehole) and high-lift pumps.

The water is delivered from the borewells into the softening plant at the rate of 2,500 gallons per minute from a depth of about 150 ft. below the surface, at which level the required quantity is obtained. However, provision has been made that, should it be required, the water can be pumped from a depth of 350 ft. below the engine-house floor level. Under this condition the plant would be steamed at 200 lb. instead of 160 lb. per square inch.

After the water has passed through the softening plant it gravitates back into the suction tank in the engine basement, from where it is taken by the high-lift pumps and delivered into the service reservoir.

The total pump horse power that has been provided for may vary from about 370 to a maximum of about 500.

The contract for the whole of the pumping machinery has been carried out by Messrs. James Simpson & Co., of London and Newark.

BOILER PLANT.

The boiler plant comprises two Lancashire boilers, 30 ft. long by 8 ft. 6 in. diameter, which are worked at a pressure of 200 lb. per square inch. Each boiler is fitted with Messrs. Hopkinson's mountings, and is equipped with Vicar's coking stokers, which are driven by means of a 3-b.h.p. motor; they are also fitted with Ferguson's sectional superheaters. A Green's improved fuel economiser of ninety-six tubes is fixed in the main flue, and a small motor is provided for operating the economiser scrapers.

The boiler flues are equipped with a patent flue-dust extraction plant, manufactured by the Morton Hogg Patent Flue Cleaner Company, of Glasgow.

For feeding the boilers a vertical duplex piston feed pump of Messrs. J. Simpson & Co.'s manufacture is provided, which acts as a stand-by to the feed pumps provided on the main engines. On the feed pipe a Worthington positive meter is fixed, so that a check is obtained on the feed water consumption.

The contractors for the boiler plant were Messrs. H. & T. Danks, of Netherton, Dudley.

SOFTENING WORKS.

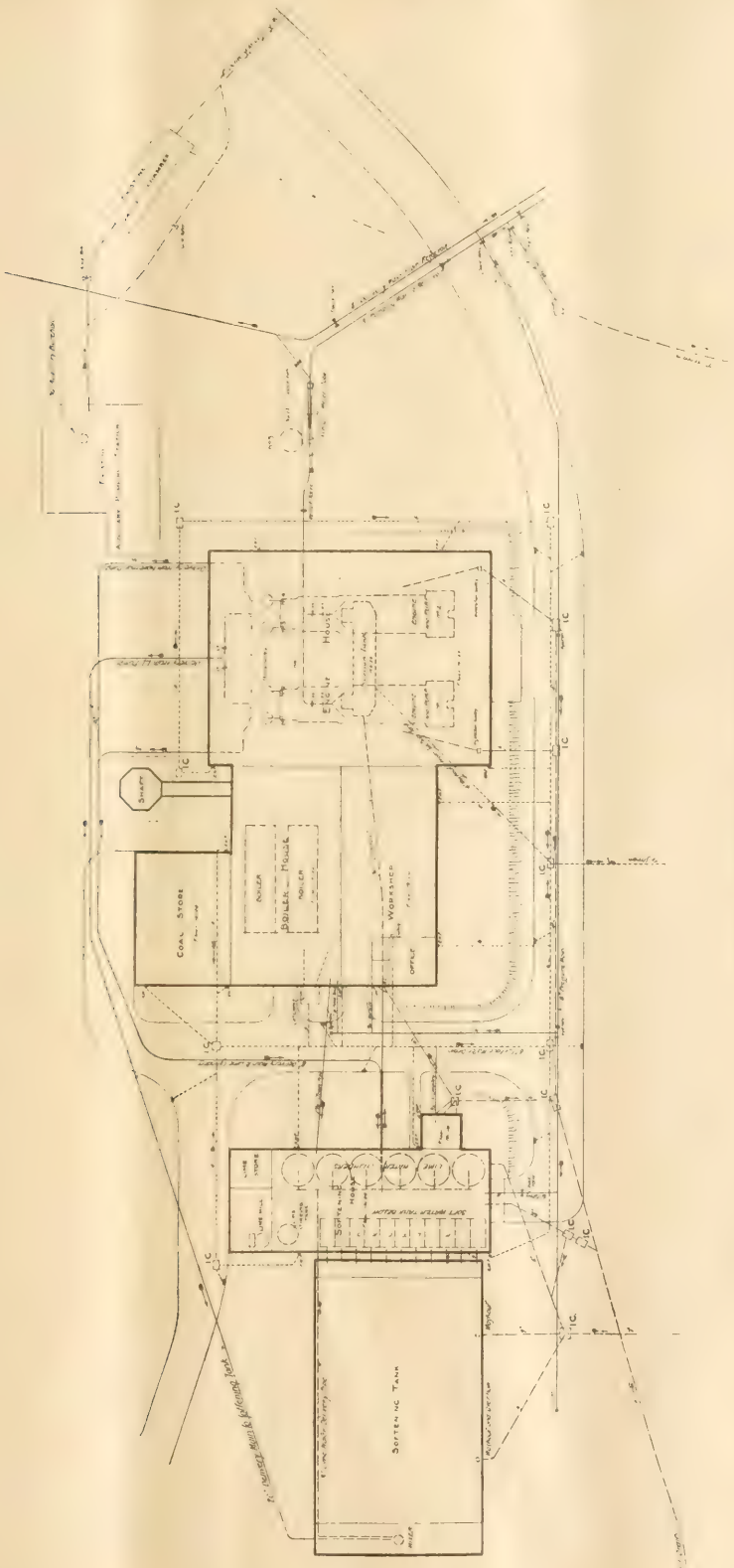
After inspecting various systems of softening water for town supplies, it was finally decided to adopt the "Haines" continuous system, and to reduce the hardness from about 21 to 6 or 7 degrees.

The softening works comprise a lime store, lime-slaking room and filter-house, with the "Haines" softening plant. Beneath the filter-house is constructed a concrete tank for receiving the softened water after filtration, and immediately adjoining the filter-house is the softening tank.

The filter-house building is similar in character to the pumping station. The softening tank is constructed above ground in concrete reinforced with steel bars and expanded metal; it is covered in, the cover being supported by reinforced-concrete piers and the baffle walls. The internal surface, with the exception of the underside of the roof, is rendered in cement and Pudlo.

The internal size of the tank is 80 ft. 2 in. by 44 ft. 3 in., and the depth of water 9 ft. 9 in., the total capacity being about 200,000 gallons.

The reagent used to soften the water is lime in the form of a saturated solution of a standard strength.



Watford Waterworks: Block Plan.

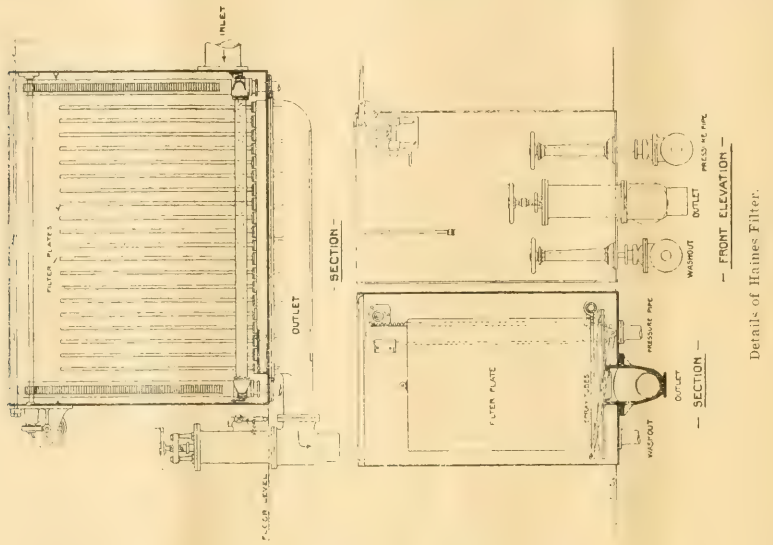
The lime is received at the works and stored in a chamber adjoining the lime mill, where the quantity for the day's working is slaked. The mill is a cylindrical tank, 4 ft. diameter by 3 ft., containing a revolving cage, into which the lime is introduced, and upon which a jet of water plays while in motion, thus slaking the lime and forming cream of lime. From the mill this passes through a strainer to a circular storage tank holding a day's supply, and in which there is a stirring gear for keeping it mixed to a uniform consistency.

Connected with the circular tank is a small lime pump, which, when required, delivers a charge of the cream of lime to any one of the lime solution cylinders. The power required to drive the lime pump, mill and stirring gear is a small motor, which is in use about two hours per day.

There are six lime solution cylinders, one always being kept fully charged to take the place of one taken out of work for charging, which operation takes but a few minutes.

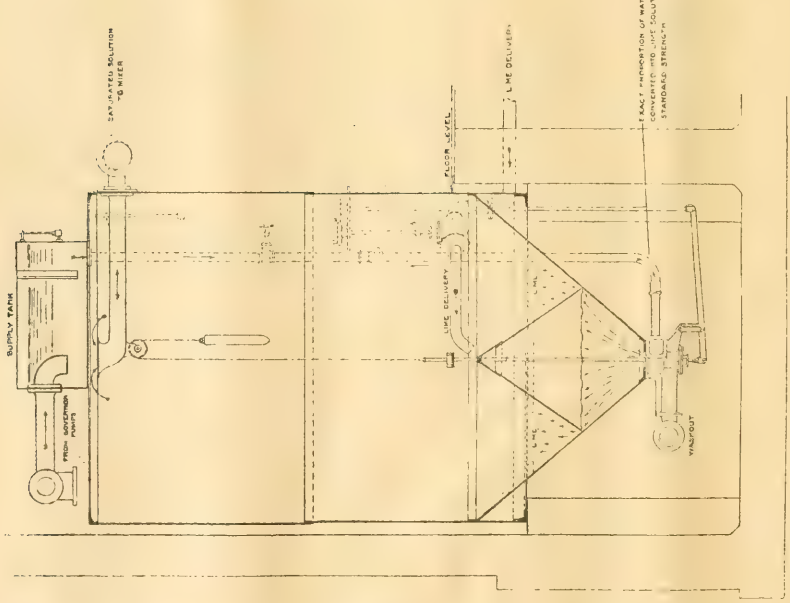
The cylinders are of steel, 9 ft. diameter by 15 ft. in height, with an open top and the lower portion in the form of a cone, and having an inner cone resting on the outer one at intervals, thus forming a series of ports; around the cone the charge of cream of lime is delivered by the lime pump. The inner cone is fixed to a continuation of the washout valve spindle, so that when the valve is opened the cone lifts and allows the residue to wash out. On a new charge being admitted the water rises to working level again.

Connected to the main pumping engines and working in direct ratio to it is a governor pump which delivers about 10 per cent of the total water pumped, to two small tanks over the lime cylinders. On the pump there are means of adjustment so that the hardness can be reduced or increased as required.



Details of Haines Filter.

Watford Waterworks.



Detail of Lime Water Cylinder.

From the tanks over the cylinders the correct quantity of water is passed to the bottom of the cylinders, where it passes through the ports on the periphery of the cone, and forms a ring of water, which, flowing upwards through the lime between the cones, takes up with it just to make a saturated solution. The action of the water in passing through the ports keeps the lime gently agitated, so that every particle of lime comes into contact with the water, with the result that there is no waste of lime, the whole of the lime can into the cylinders being converted into solution.

At the top of the cylinders the lime water flows into a bell-mouth pipe and is conveyed by gravitation to the mixer at the far end of the softening tank. Here the lime water meets the low-lift pumps enters by a vertical pipe and falls into the tank over the edge of a large bell-mouth in a thin sheet. A uniform and steady flow of water is obtained by the vertical pipe being of much greater area than the delivery pipe to it.

Above the bell-mouth and concentric with it is a circular basin with a turned curved lip of a less diameter than the bell-mouth. The lime solution gravitating to the basin flows over the edge in a thin sheet, and is at once intimately mixed with the sheet of hard water flowing over the bell-mouth, and as they together fall into the tank they are thoroughly mixed broken up, and aerated.

The water thus mixed flows slowly through the softening tank where ample time is allowed for the chemical reaction to be complete before the water is filtered; the water in its passage through the tank passes under a baffle and over the mixer and over a weir before entering the filters.

The softening process having been completed a large portion of the carbonate of lime in suspension is deposited in the tank, the remainder is removed by means of the "Hoppes" patent filters.

There are eleven filters, each occupying the space of 8 ft. by 4 ft. by 6 ft., and having an effective filtering area of 540 sq. ft., capable of filtering at least 12,000 gallons per hour continuous.

Each filter tank, which is of steel, contains a series of rectangular plates, so arranged that both sides are used for filtering, thus giving a large filtering area in a small space. An envelope of special woven cloth is slipped over each plate and fastened in a simple manner by a grip ring.

The softened water on being admitted to the filter, percolates through the filtering medium, leaving the deposit on the face.

On the bottom of each tank is a collecting chamber furnished with twenty openings or ports, into each of which one of the filter plates fits and forms a joint on it, with a rubber ring on a projection on the bottom; any single plate can readily be withdrawn and bag replaced in a few minutes when required.

From the softening chamber the softened water is delivered quite clear to a tank under the filter house, and thence flows to the suction tank of the high-lift pumps of the main pumping engine.

The cleaning of a filter, which is usually done about once a day, can be carried out in a few minutes without disturbing or removing any part whatever. It is carried out by a set of spray tubes in the form of a grid, these are free to move up and down between the filter plates. The tubes are furnished with a series of small holes in each side of tube and drilled at an angle of 45 degrees so as to project the water downwards.

The operation of cleaning a filter is as follows: By opening a valve connecting the cleaning gear with the water main, the grid of spray tubes which is carried on two rams fixed inside tank, and are actuated by the pressure of water from the main, is raised to the top of filter plates, the water is then automatically released from the rams to the spray tubes, which washes the deposit from the filtering medium on its downward journey. On reaching the bottom the water is automatically shut off and the filter ready to work again.

Above the outlet valve of the filter a steam connection from the boilers is made for the purpose of sterilising and cleansing the cloth by steam about once a month.

The waste pipes from the cylinders, filters and softening tank are arranged to discharge to the lowlying land, where deposits will be formed of the deposit. It is proposed to separate the deposit from the filters, as this will have a marketable value.

The contractors for the softening plant were Messrs. C. J. Haines & Co., of Rogate House, Worple road, Wimbledon S.W.

RESERVOIR.

At the commencement of the war it became necessary to apply to the Treasury for sanction to borrow money to proceed with the scheme, and as it appeared unlikely that they would sanction money for completing the whole of the scheme it was decided to postpone the construction of the reservoir and the laying of the major portion of the delivery and pumping mains until after the war, and in the meantime to connect up to our present system. The reservoir is therefore part of the scheme yet to be completed.

It will be constructed on a clay site at Merryhill, Bushey, about 1 miles from the extreme point of supply as the crow flies and at a level that will give a static head of 136 ft. more than is given by the existing reservoir. This elevation will obviate the use of the electrically driven pressure pump, which provides an artificial head for the higher parts of the town.

The reservoir will have a capacity of 2,000,000 gallons, with its top water level at 446 ft. above Ordnance Datum. It will be 200 ft. in length by 109 ft. in width, with a depth of water of 15 ft., and will be divided into two compartments by a division wall 10 ft. in height. The walls and reservoir bottom will be in concrete; the roof and roof beams will be in reinforced concrete, supported by piers in blue brick spaced 15 ft. 4½ in. and 15 ft. 5 in. apart. The division wall will also be in reinforced concrete, carried by reinforced buttresses; these will be continued up as piers to support the roof in place of a line of brick piers. Internally the walls and floor, and externally the roof, will be waterproofed with ¾ in. of cement rendering, fillets being run to all internal angles.

The valves controlling the inlets, outlets, and washouts are all arranged in chambers outside the reservoir so that none of them will be under water.

A recorder house is arranged at one corner of the reservoir for accommodating the float gear for an electrical recorder at the pumping station. Access to the reservoir can also be obtained at this point as well as at three of the ventilators in the reservoir roof.

The site of the reservoir has a considerable fall, necessitating one side of the reservoir being 12 ft. out of ground. The excavated material will be used in forming banks round the reservoir and for covering the roof with 15 in. of soil; the remainder will be deposited and levelled on the site.

PUMPING AND DELIVERY MAINS.

The water is to be delivered eventually by the high-lift pumps through an 18-in. cast-iron main, 3,960 yds. in length, to the new reservoir, to be constructed at Merryhill, Bushey. From the reservoir the water will be delivered also through an 18-in. cast-iron main, 5,830 yds. in length, to the High-street cross roads. At this point the main is connected to the existing mains, and also at three other points on the route.

The contractors for the supply of the cast-iron pipes and special were Messrs. Cochrane & Co., Woodside, Dudley; for the supply of valves and fittings, Messrs. Bladenborough & Sons, of Brighouse; and for the laying of the mains the contractor was Mr. R. Ashley, of Mansfield.

Recruiting Authorities and District Council.—At Golgaer, Cwm Tribunal, last week, applications were made by the urban district council for the exemption of seven of their employees, whose ages ranged from twenty-five to thirty-one. The military representative said the recruiting authorities had instructed him to oppose as far as it was wise the exemption of any man under thirty years of age, and they wished him to express surprise at the action of the district council in appealing for so many young men. Exemption for one month was granted a deputy sanitary inspector, aged twenty-five, and married. A surveyor's clerk, aged twenty-seven, single, was granted six months' exemption on the ground that he had been placed in Class C 3. For a similar reason the engineer and caretaker at the council's isolation hospital was granted six months' exemption. A steam roller driver was also granted six months' exemption on the grounds of indispensability, and that he was thirty-nine, and married. An assistant surveyor was given one month's exemption.

WITHERNSEA WATER TOWER.

GROUND RESERVOIR AND ELEVATED TANK IN ONE STRUCTURE.

Among the many water towers constructed in reinforced concrete in Great Britain, one of the most interesting is that recently erected for the Hull City waterworks, for the water supply of the South Holderness district. The circumstances required one reservoir of 300,000 gallons capacity at ground level, and one of 100,000 gallons capacity 60 ft. higher.

The design on which the tanks were constructed combined the ground reservoir and the elevated tank into one structure. An attempt was also made to render the erection pleasing architecturally, with the result that the completed structure, besides being undeniably of extremely sound construction, is also of a very imposing character.

The lower tank is 56 ft. 6 in. in diameter, measured to the outside of the circular walls. The depth of water in the tank is 20 ft. The bottom slab of the tank, which is 6 ft. 6 in. below the ground level, varies in thickness. Inside the tank are eight columns placed on a circle of 13 ft. 9 in. radius con-

Hull City Water Tower.

centric with the circular wall of the tank. These columns passing through and supporting the roof of the lower tank are continued upward to carry the elevated tank. The portion of the bottom slab which forms the foundation for these columns is octagonal in plan, 8 ft. wide and 2 ft. 6 in. deep. This is reinforced with ¾-in. Kahn rib bars radially at 7-in. centres, and also concentrically at the same centres with additional bent-up bars directly under the column. The bottom slab inside this octagon is 1 ft. 6 in. thick, and forms the foundation to four columns placed at 7-ft. centres round the centre of the tank, which support the roof and are specifically provided to carry a reinforced-concrete shaft which gives access to the upper tank. This slab is reinforced with ¾-in. bars at 8-in. centres placed in two directions, with additional bent-up bars under the columns. The portion of the bottom slab outside the octagon is 9 in. thick.

The side wall of the lower tank varies in thickness from 10 in. at the bottom to 6 in. at the top.

THE UPPER TANK.

Perhaps the upper tank may be described as the predominant feature of the structure. This tank is designed on the balanced system, which is a characteristic of the majority of elevated tanks designed on the Kahn system of reinforced concrete. The tank, as already stated, has a capacity exceeding 100,000 gallons. The internal diameter is 40 ft., with a maximum depth of water of 15 ft. 9 in. The main support to the tank consists of a circular beam of a mean radius of 12 ft. 10½ in., carried on the eight 20-in. by 18-in. columns. This beam arches from 5 ft. deep at the columns to 3 ft. deep at the centre, and is the same width as the columns—viz., 20 in. This beam is reinforced with four ¾-in. bars in the bottom, two of which are bent up over the support, and two ¾-in. bars in the top, which lap 4 ft. at the supports; ⅜-in. stirrups are provided at 9-in. centres throughout the beam. The bottom slab of the tank, which is 12 in. thick, spans between the circular beam and the central shaft, and is reinforced with ⅝-in. bars alternately bent and straight at a maximum spacing of 9 in. centre to centre; ¾-in. bars placed concentrically at 12 in. c.c. form the distributing reinforcement.

The sloping side of the tank, which in this case has an overhang of about 7 ft. over the columns, is the outstanding feature of all water towers of the balanced type. The slab is 8 in. thick, and is reinforced to resist the pressure of the water with two sets of circular ¾-in. bars placed at 6½-in. centres with two sets of ¾-in. bars placed radially at a maximum distance of 12 in. centre to centre. At the top of the sloping side a main tension of bars is designed to carry the dead weight of the vertical wall and the load coming on it from the roof.

The vertical wall is 7 in. thick, and is reinforced with rings of ½-in. bars.

This water tower has been erected on the Kahn system of reinforced concrete, to the designs of Mr. C. B. Newton, M.Inst.C.E., and the contractors who carried out the work were Messrs. T. Goates & Son, of Hull. The reinforcing details were prepared by the Trussed Concrete Steel Company, Limited, Caxton House, Westminster, who have had extensive experience in the construction of water towers.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάνθ' ὁρᾷ
(One man does not see everything.)
—Euripides.

AIR RAIDS AND WOOD PAVING.

To the Editor of The Surveyor.

Sir,—With reference to the "Minute" in The Surveyor of the 13th inst. as to the effect of an incendiary bomb falling on a street paved with creosoted wood blocks, and the possible consequence of such a pavement taking fire, I do not consider that any serious conflagration could possibly ensue. It is well known that fire cannot spread, or even exist, without air, and the fact that the wood blocks are closely packed and bedded tight on an impervious concrete foundation would make it impossible for the necessary supply of oxygen to feed the fire. There might possibly be a slow and very partial smouldering of the pavement and a good deal of unpleasant smoke from the creosote, but nothing in the nature of a fire that could not readily be extinguished.
—Yours, &c.,

M.Inst.C.E.

October 16, 1916.

Main Road Control in Herefordshire.—A proposal of the Roads and Bridges Committee of the Herefordshire County Council to take over direct control of the main roads, instead of maintaining them through the district councils as agents, has met with such opposition from the latter bodies that on Saturday (the *Birmingham Post* reports) the county council decided to let things remain as they are for the present. The county surveyor had presented a preliminary report, which tended to show that savings could be effected on haulage and contracts if under a single directing hand, and that a further saving could be made by the prevention of overlapping. At the meeting of the county council on Saturday, the vice-chairman (Alderman H. F. Russell) said that the council having solicited the opinions of the district councils, they could not flout them. The surveyor had an answer correcting the chief points of the replies which were at variance with his own statements, but in view of the circumstances he (Alderman Russell) agreed with the surveyor that it was better to let the matter drop than risk friction, which would destroy harmonious working.

The Surveyor
And Municipal and County Engineer.

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THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather refreshing to find that at a recent meeting of the Newton, Devonshire, Rural District Council a member should have been found, not complaining of the bad condition of the roads, but actually complaining of a road being too well maintained? Is it not very rare to find criticisms of this description, especially in Devonshire, where the roads are, in some instances, a long way from perfection?

* * * *

Has anyone been to see the foundations that are being put in for the widened road in St. James's Park, near Storey's Gate? Would they be surprised to find that brick rubbish, about 2 ft. in thickness, is being put in as a foundation for a road that has very light traffic, and that will probably be finished with old-fashioned water-bound macadam? When will H.M. Office of Works take a few elementary lessons in road making?

* * * *

Should not the Tilbury Urban District Council be jubilant at the increase of their rateable value which will be brought about by the recently completed revaluation of Tilbury Docks? Is it a fact that this increase in rateable value will swell the income of this fortunate district to an extent of some £5,000 a year? How are the council going to spend it?

* * * *

In refusing Lady Mabel Smith's application for work on the highways of the district so as to release a man for other work, was it not very wise of the Wortley Rural District Council to alter the wording of a committee which recommended the refusal from "they did not consider the work demanded from a road labourer was suitable for a lady of her position" to "they did not consider the work demanded from a road labourer was suited to a woman"? May we not also hope that they really thought so?

* * * *

Are not the Hornsey Borough Council to be congratulated on the course they pursued the other day when a member of that body moved a resolution to the effect that the salaries of some of the higher officials should be reduced, by gradually leaving the council chamber so that there was a "count out," the proposal thus falling through? Was not this an example that might well be followed by other councils who often carry on long discussions on their officials' salaries, which must be extremely painful and distressing to the officers concerned?

What is wrong with Kenilworth, that, during a recent discussion on the request of the Local Government Board for information as to works contemplated in the district, one of the members should have asked if anything could be done "to prevent Kenilworth getting any more ugly than it has done during the last few years"? Is the fact of the prosperity of any town, as evidenced by the growth of manufactories, &c., to be taken as evidence that it is declining in appearance?

* * * *

Is it not rather to be regretted that a domestic supply of water cannot be given through a meter? Is the cry that if this were done an insufficient quantity of water for hygienic purposes would be used a true one, and is it not only a bogey, which can only be disproved by a trial of the meter measurement system?

* * * *

Is it not to be regretted that it has been decided to construct tramways in Princes-street, Edinburgh, on the overhead system? Is not this street one of the most beautiful in Europe, and will not the unsightly clothes-line system go far to destroy the present unique character of this thoroughfare? Could not the underground electric conduit system have been applied at once instead of proposing to instal the overhead and note the effect? Is not this proposal rather on the lines of the penny wise and pound foolish proverb?

* * * *

Should not road surveyors in this country think themselves fortunate that they have to deal with motor-'bus traffic and not that of byle gharries, when in the *Indian and Eastern Engineer* of September it is stated that, "Tar-macadam is . . . not a suitable material to carry heavily loaded byle gharries with wheels shod with such attrocities as half-round iron"? What is a byle gharrie, and is it drawn by bullocks or elephants? And why can't some legal steps be taken to prohibit the use of such "attrocious" tyres?

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATION FOR LOAN.

Holme Cultram U.D.C. £1,000 for sewerage works.

LOANS SANCTIONED.

Bo'ness T.C. £12,000 for the extension of the electricity works.

Chesterfield T.C. £20,600 for extensions to the electricity works.

Ossett T.C.—£500 for a concentrated ammonia plant at the gasworks.

Stockton T.C.—£3,536 for gas meters and mains, gas and electricity mains, and sewerage works.

Wakefield T.C. £3,000 for the provision of an economiser at the electricity works.

FORTHCOMING INQUIRY.

OCTOBER.	£
24.—**Bristol.** For the purchase of property (Mr. R. C. Maxwell)	9,396

The Cannon-street Subways.—The street subways in Cannon-street, London, which have been in course of construction for some time, have now been completed.

A Scottish Voluntary Water Rate.—There is a deficit on the Newton Mearns water undertaking, and the inhabitants have agreed to the imposition of a voluntary rate of 3d. per £1 on owners and 2d. per £1 on tenants to raise the necessary revenue.

A Memberless Council.—An extraordinary situation has arisen in connection with the Disley (Cheshire) District Council. Some of the members have resigned, while others have joined the Colours, and now there are only three left, and the business of the council is at a standstill, the district surveyor having also joined the forces. The matter is now being taken up by the ratepayers and the Local Government Board is to be approached.

War and the Economic Aspect of the Housing Problem, with Special Reference to Mid-Lanark Housing Scheme.*

By WILLIAM ROSS YOUNG, Town Planning Engineer, Middle Ward of Lanarkshire.

(Conclusion.)

There has recently been adopted in connection with the housing of munition workers a comparatively new type of house, in the form of a quadruple cottage. This type of house is at present being built under the direction of the Local Government Board at Inchinnan, Renfrewshire, and promises to be very successful. The massive appearance which it is possible to give this class of building has a balancing effect on the whole scheme. A similar design was prepared in connection with a Middle Ward scheme, and is shown as type J. The estimated cost per house last March was £310, showing a reduction of £30 per house over the double cottage type. In recent years there has been a great striving after simplicity and economy in the erection of cottages, and this flatted type goes far in that direction.

STANDARD DESIGNS.

In view of the building activity that is likely to follow the termination of the war, and the part that local authorities may be asked to take, there seems great need for a number of standard designs being drawn up and generally agreed upon by local authorities as best meeting the position, both as regards the number and size of rooms and the mode of design and construction. In this way materials and fittings could be standardised and consequently cheapened. The standardisation of fittings and material has been adopted in Mid-Lanark schemes to a very great extent, and, while the various types of houses have differed considerably in both plan and elevation, standard sizes have been adopted throughout for main timbers, as well as for windows, doors and other fittings.

There is greater need now than ever before for considering carefully how far new and cheaper modes of construction and material can be produced to meet the extra cost of building due to the war without reducing the size or sanitary standard of the houses. In this connection we should note the rapid evolution which has taken place in the erection of cottages of a semi-permanent nature for the accommodation of soldiers and war workers. The extremely high cost of timber and corrugated iron has compelled those responsible for the erection of such houses to consider the introduction of new material. The wood and corrugated iron buildings have now disappeared, and to-day their place is being taken in most cases by one or other of the many forms of concrete construction which have been evolved. At Alexandria, in the Vale of Leven, for example, three-room and kitchen cottage houses are being quickly and successfully erected—under the direction of the Local Government Board of Scotland in concrete. The external walls of these cottages are only 3 in. thick, strengthened at intervals by 9-in. piers. This mode of construction was adopted shortly

Mossend, Mid-Lanark, Housing Schemes.

Three types of houses (in blocks of two)—viz., A, B, C, are being erected on the following sites, in the undernoted proportions :—

Type.	Coronation road.	Unthank road.	North road.	Total of each type.
A—One storey, containing room and kitchen, larder, bathroom, w.c., and coal cellar	—	—	16	16
B—Two storey, containing two rooms and kitchen and conveniences, as above	32	28	56	116
C Two storey, containing three rooms and kitchen and conveniences, as above	18	22	28	68
Total number of houses	50	50	100	200

Note.—The undernoted costs are based on the accepted offers for North Road site. The cost of roads and fencing, which is estimated at £17 per house, is excluded.

Type.	Cost.	Cubic contents of building (measured externally).	Price per cubic foot of building.	Super. floor area including presses and lobbies (excluding stairs).	Price per super. foot of floor area	Cubic contents of habitable space, including presses but excluding stairs.	Price per cubic foot of habitable space.
A	£250	8,881 cubic feet	6·75d.	511·75 super feet	9s. 9d.	4,339·50	13·82d.
B	290	11,060 ,, ,,	6·29d.	635·75 ,, ,,	9s. 1½d.	5,065·00	13·74d.
C	300	11,168 ,, ,,	6·44d.	630·00 ,, ,,	9s. 6½d.	5,064·00	14·21d.

Superficial area and cubic contents of each apartment.

Type.		Kitchen	Scullery.	Bathroom	Larder.	Coal cellar.	Presses and lobbies (excluding stairs).	Bedroom No. 1.	Bedroom No. 2.	Bedroom No. 3.	Totals.
A	Sup. floor area ..	198·50	66·50	26·25	12·00	12·50	20·00	176·00	—	—	511·75
	Cub. contents ...	1,629·50	598·50	225·00	108·00	112·50	170·00	1,496·00	—	—	4,339·50
B	Sup. floor area ..	183·50	53·50	26·25	13·50	12·00	58·00	142 50	146·50	—	635·75
	Cub. contents ..	1,530·25	481·50	225·00	121·50	108·00	381·75	1,169·75	1,047·25	—	5,065·00
C	Sup. floor area ...	183·50	53·50	26·25	13·50	12·00	58·00	126·25	97 50	59·50	630·00
	Cub. contents ..	1,530·25	481·50	225 00	121·50	108·00	381·75	1,033·00	786·00	397·00	5,064·00

Note.—Concrete foundations; 12-in. hollow brick walls; cement rough-cast outside; 3 coats plaster inside; roofs slated. Hot-water high pressure boiler at range, with 25-gallon circulating tank connected to bath and sinks.

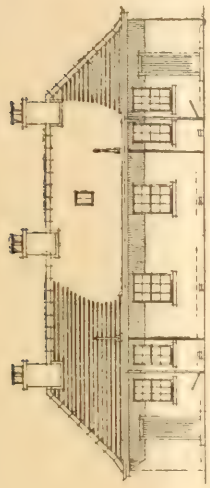
* Paper read at the forty-second annual congress of the Incorporated Sanitary Association of Scotland.

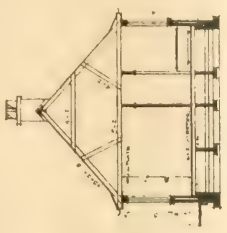
after the outbreak of war at Richmond and other camps, and, according to a report recently made by the board's engineering and architectural inspectors, have proved quite satisfactory. The Middle Ward District Committee, recognising the potential value of concrete as a mode of construction, especially in those districts where slag and such material can be readily obtained, has introduced as an experiment the erection of cottages with hollow concrete walls. The external walls of these consist of concrete slabs, 2½ in. and 3 in. thick respectively, having a cavity of 3 in.; they are roughcast externally and plastered on the solid internally, with slated roofs. These cottages are similar to type B, and so far promise to be as successful as the brick cavity wall system.

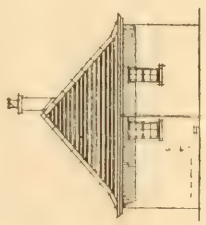
Having in view the need for the more rapid erection of houses for munition workers, the District Committee, at the request of the Local Government Board, have prepared plans and estimates for similarly constructed two-room and kitchen cottages, one storey in height. This plan, which is shown as type H, is estimated at the present time to cost £220.

BUILDING COSTS.

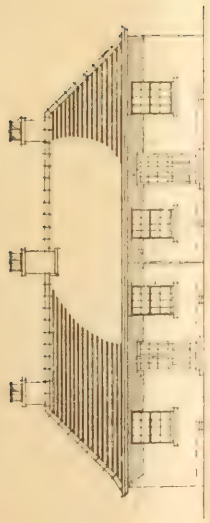
By the adoption of new and cheaper material the cost of cottage construction has in recent years been considerably reduced below that which would otherwise have obtained, but it is felt in many quarters that there is still a great need for a thorough and concentrated study, with a view to still further reducing the cost of erection. Some means must be sought, for example, whereby an efficient hot water supply can be got at a much reduced cost. Arrangements must be made for the relaxation of those building by-laws which are not necessary in the control of cottage building. Back projecting wings and excessive roof cutting must be avoided, timbers reduced where possible, and the rejection of all useless orna-

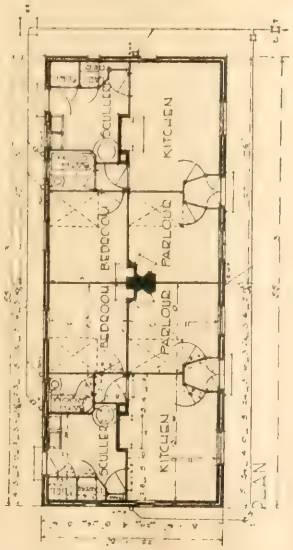






Mid-Lanark Housing Scheme: Type H Dwellings.





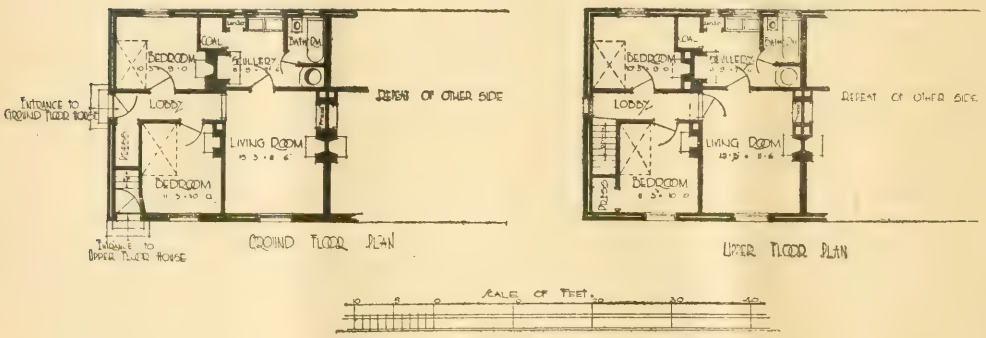
mentation. In short, we must specialise in the art of cottage construction, having efficiency and cheapness more in view. The question of the cost of timber is likely to be a grave one for many years after the war, and the question as to what extent it can be replaced by other suitable material will have to be considered very closely.

SITE.

Having determined in a general way the class of cottages and mode of construction which should be adopted, perhaps the next most important matter is the selection of a suitable building site, and if economy is to be ensured this must be carefully done. If the

ground is undulating, the expense for under-building will be great, notwithstanding how careful the ground may be contoured and the lay-out adjusted to suit these contours. It is therefore preferable where houses for the working classes are under consideration not to select unduly undulating land. The amount of land which will require to be taken will depend on the density that is to be aimed at, but any attempt to exceed a density of twelve houses to the acre should be discouraged. Such a density permits of a fair garden, both front and rear, and good spacing between the houses. In no case should the building line between the fronts of the houses be less than 70 ft. Where terrace houses are adopted the density can, without giving a cramped feeling, be kept a little higher than where double cottages are erected, but even then the density should not exceed twelve houses to the acre.

FRONT ELEVATION.



Mid-Lanark Housing Scheme: Type J Dwellings.

Width of Streets.

There has been no question more generally discussed recently in connection with housing schemes than the width of streets, and which forms a considerable factor when considering the relation of cost as between tenements and cottage construction. Since, however, local authorities have obtained power under the Housing and Town Planning Act to plan out areas in advance, they are able to grade the width of their streets according to the traffic which will be thrown upon them, that is to say, they know in advance what streets are to be main streets and what streets are to be subsidiary streets. In this connection I may state the Middle Ward District Committee have drawn up a general development plan of the districts affected, and determined the width of new streets in relation to the area as a whole.

In the preparation of "after-war housing programmes" by local authorities, one of the factors which must be most difficult to determine in arriving at a suitable basis to go upon as regards the cost is the uncertainty in forecasting the cost of building. It is generally agreed, however, that it will be considerably higher than pre-war prices. It is thought by those best ab o judge that a rise of 30 per cent over pre-war prices might be a fairly representative figure. Before the war broke out a two-room and kitchen cottage—type B—could be erected at about £230, so that a 30 per cent rise would represent an increase of almost £70, or an after-war price for this type of cottage of £300. On this basis it would appear that in order to erect working-class cottages at such a cost as would enable a local authority to let them at a rent comparable with pre-war rents, there would require to be made a grant or subsidy to the extent of about £70 per house. While it is true that rents all over will likely be raised somewhat above those prevailing in pre-war times, it is thought that any such rise in rent would not more than meet the increased interest and other burdens.

In any case, it is contended that local authorities ought to be prepared with a "housing programme" which could be put in operation at the termination of the war, and that they should now set about selecting provisional sites, preparing plans, specifications, estimates, balance sheets, and other necessary data; for, while there may have been some excuse for our having been unprepared for war, there can be no excuse offered if we are not prepared for peace and that great industrial reorganisation and absorption of unemployment that will be necessary when that time comes.

MUNICIPAL OFFICIALS' PETROL ALLOWANCES.

QUESTIONS IN THE COMMONS.

In the House of Commons the President of the Board of Trade was asked by Mr. Patrick Meehan whether he was aware that the allotment of petrol in Ireland was absolutely unsatisfactory; that there was a total disregard of the wants of the applicants; and that surveyors and officials of corporate bodies were only allowed 10 and 20 per cent of their actual average supply, whereas owners of big pleasure cars were allowed double the quantities they previously used.

Mr. Runciman: I think the hon. Member must be mistaken about the proportion allowed. I am not aware of any cases in which the allowance to officials of public authorities has been cut down to anything like that percentage.

Mr. Meehan: I can give the right. hon. gentleman particulars.

Manchester Summer Time Gas Consumption.—Manchester Gas Department figures show that the Summer Time Act decreased the consumption of gas between six o'clock in the evening and one o'clock in the morning by 134,000,000 cub. ft., and saved 11,000 tons of coal.

The Activated-sludge Process.—The latest experiments and conclusions derived therefrom relative to the activated-sludge method of treating sewage formed an important part of the convention of the American Society of Municipal Improvements which took place last week at Newark, N.J., papers on the subject—which we hope to refer to in a later issue—being presented by Messrs. George T. Hammond, engineer-in-charge of the Brooklyn, N.Y., Experiment Station, T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, G. J. Requardt, formerly with the Baltimore Sewerage Commission, and Harrison P. Eddy, consulting engineer, Boston.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aldershot U.D.C.—A letter has been received from the Local Government Board refusing to sanction a proposed loan of £1,000 for public conveniences.

Banchory T.C.—The town council have agreed to participate in the scheme for a joint county hospital. The capital cost will be £100 with a payment of £20 per annum.

Bridport T.C.—Repairs are to be carried out at the town hall at an estimated cost of £170.

Essex C.C. Repairs are to be carried out at Roydon Bridge at an approximate cost of £150.

Hunstanton U.D.C.—The surveyor, Mr. J. C. Walker, has been instructed to prepare a plan and estimate for a building to house the vertical boiler at present in the refuse house.

Newton Abbot U.D.C.—The surveyor, Mr. C. D. White, has been instructed to prepare an estimate of the cost of erecting a suitable lodge in Baker's Park.—The question of building a public slaughter-house has been referred to the Sanitary Committee.

Nuneaton T.C.—The acting borough surveyor has received instructions to carry out repairs at the lodge and chapels in the cemetery.

St. Ives T.C.—The town council have received the sanction of the Public Works Loan Board to the expenditure of £1,400 on the reconstruction of a breakwater at the Smeaton Pier. The plans, which were prepared by the borough surveyor, Mr. S. Pafford, have been approved by the engineers, Messrs. Coode, Matthews, Fitzmaurice & Wilson, with a slight alteration.

Somerset C.C.—The Public Health and Housing Committee recommended that, as no steps had been taken by the Bath, Clutton, Midsomer Norton, and Radstock Joint Hospital Committee as to the erection of an isolation hospital after the war, the Hospital Committee should be reconstructed in accordance with the decision of the House of Lords in the recent Derbyshire case. The recommendation was, however, referred back for further consideration.

HOUSING AND TOWN PLANNING.

Clayton U.D.C.—The council have been advised by the city surveyor of Bradford, Mr. W. H. S. Dawson, to decide upon their town planning scheme, so as to be ready with Bradford to carry out the work as soon as possible after the war. The area of the Clayton scheme is about 811 acres.

Henley-on-Thames R.D.C.—It is proposed to hold an inquiry into a complaint of an insufficiency of working class dwellings at Hlgmoor.

Lanark C.C.—An intimation has been received that the Minister of Munitions was considering the erection of houses in Cambuslang and Carmyle districts. It was suggested that the houses might be taken over by the local authority after the war upon a valuation, and the county council have agreed to this proposition.

Oldham T.C. The Housing and Town Planning Committee submitted the final statement of accounts for the municipal dwellings. It showed that the original contract price for the twenty-four cottages was £4,910, and that extras came to £390, making the total building cost of the houses £5,300. To this had to be added £39 2s. 6d. for wash-boilers and £11 0s. 5d. for coke for drying, making a grand total cost of £5,350 19s. 8d.

Tilbury U.D.C.—Negotiations are proceeding in connection with the acquisition of land for the extension of the housing scheme.

MOTOR TRANSPORT.

Barnsley T.C.—The Watch Committee have been notified that the Local Government Board are not able to sanction a loan for a motor fire engine at the present time, and in these circumstances the committee have postponed the consideration of the report presented by the chief constable, but have authorised him to make arrangements for the hire of horses and a taxi to be at the immediate call of the brigade.

Bromsgrove U.D.C.—The Lighting Committee are considering a proposal to purchase a motor fire engine and establish a fire brigade in conjunction with a neighbouring council.

Dartford R.D.C.—A steam tractor is to be purchased at a cost of £500.

Selkirk C.C. A decision has been reached to purchase a steam tractor with two wagons, at a price approximately of £750.

Stirling C.C.—The chief constable has been authorised to purchase a motor bicycle with side-car, at a cost not exceeding £100.

Stoke-on-Trent T.C.—The Watch Committee recommend the town council to consider the purchase of a motor fire engine for Hanley.

PARKS AND OPEN SPACES.

Ventnor U.D.C.—A committee has been appointed to select a site for a public bowling green.

REFUSE COLLECTION AND DISPOSAL.

Glasgow T.C.—The superintendent of cleansing, Mr. William Greig, reported to the Cleansing Committee as to a correspondence which he had had with the British De-Tinning Company regarding the new process for dealing with old tins which that company propose to put into operation in this country. Mr. Greig stated that the amount of old tins collected by the department is about 1,000 tons per annum; that previous to the outbreak of war these tins were sold for export to Germany; that the contract then in force had to be cancelled; that a regular market for the tins cannot now be got; and that, in consequence, there are large accumulations at the various works. In view of the importance of this question to the department it was recommended that one member of the committee, together with the superintendent and the assistant superintendent, be appointed to attend the forthcoming meeting in London at which the company's scheme is to be explained.

ROADS AND MATERIALS.

Ardsley U.D.C.—The surveyor, Mr. John Morley, has received instructions to carry out repairs to Pontefract-road, at an estimated cost of between £300 and £400.

Ballycastle R.D.C.—It is reported that the construction of the coast road near Cushendall has been practically completed, at an expenditure up to the present of £4,651.

Chichester T.C.—The city council have agreed to a report of the Highways Committee adopting a recommendation passed at a conference of local authorities that motor 'buses running between Midhurst and Chichester should be charged 3d. per 'bus-mile.

Devon C.C.—In consequence of the condition of portions of the main roads, the Bridges, Main Roads and County Buildings Committee recommend the withholding of £50 from the next quarterly payment due to the Southmolton Rural District Council.—The committee similarly recommend the deduction of £200 and £250 from the accounts of the Barnstaple and Crediton Rural District Councils respectively. It apears that Southmolton Rural District Council on certain roads let the whole of the manual work, including the cleaning of water-tables and drains, to contractors, which method has repeatedly been condemned by the county council as a most unsatisfactory one, and the committee as a preliminary step have asked the district council to submit their observations on the matter.

Eastbourne R.D.C.—The Road Board are being asked to consider the claim for compensation for damage done by military traffic on the Hove road.

Edinburgh T.C.—With respect to the yearly estimates for street maintenance and repairs the custom hitherto has been for the city road surveyor to fix the sum needed for repairs, on an average of the

estimate for a series of years. The Streets and Buildings Committee have now decided that the road surveyor should make a survey of all the streets he thinks will require attention, and submit an estimate of the cost of repair.

Goole U.D.C.—A scheme prepared by the surveyor, Mr. J. H. Castle, for the widening of Swinefleet-road will be submitted to the West Riding County Council.

Halifax T.C.—In connection with an important improvement scheme at Bull Green and Barum Top, which has been suspended by the war, the corporation are engaged in widening the present street almost double its width, at an estimated cost of £500, which will be paid out of revenue.

South Westmorland R.D.C.—It is proposed to carry out an improvement of the dangerous corner at Bark Booth Hill, Crosthwaite.

Westminster B.C.—The city council have been invited to contribute towards the cost of a further extension of the Thames Embankment, between Lambeth Bridge and the existing embankment wall of Grosvenor-road, immediately to the south of Grosvenor wharf. The scheme includes a proposal to widen Horseferry-road to 60 ft. between St. John's-gardens and Grosvenor-road, and an improved western approach to a reconstructed Lambeth Bridge. The approximate cost will be £80,000, and towards this the Improvements Committee recommend the city council to contribute one-sixth, £13,333. The property required forms part of the Grosvenor estate, and the leases expire in the years 1920-1-2.

SEWERAGE AND SEWAGE DISPOSAL.

Chatham T.C. The estimated cost of the proposed internal scheme of sewerage is £86,500.

Clutton R.D.C.—Plans are to be prepared for a scheme of sewage disposal at Hobbs Wall, Farnborough.

Hebburn U.D.C.—The deputy surveyor has been instructed to report on the cost of a suggested scheme for the prevention of floods at the foot of Ellison-street and Bonacord-street.

Hunsworth U.D.C.—The new outfall works in the lowest portion of the district, adjoining the Spen beck, were formally opened recently. The engineer was Mr. H. A. Johnson, of Bradford.

Langholm T.C. Mr. Gilbert Thomson has visited Langholm to enable estimates to be made of the cost to each manufacturer or manufacturing firm carrying out works to purify the effluents from their mills before discharging them into the river Esk.

Margam U.D.C.—A committee has been appointed to report on a proposal for main sewer diversion and the construction of a new sewer at Port Talbot, the cost of which is estimated at £9,500.

Newry U.D.C. The surveyor, Mr. E. Blaney, has been instructed to confer with the county surveyor with a view to the preparation of a surface-water drainage scheme.

Seaham Harbour U.D.C.—After considering the scheme of the surveyor, Mr. F. E. Boaz, for remedying the flooding at the south side of the town, the Health Committee have asked him to report further upon the matter.

WATER, GAS, AND ELECTRICITY.

Alnwick R.D.C.—A proposal for a water supply scheme for Alnmouth is being inquired into.

Ballycastle U.D.C.—The council's engineer has received instructions to make a thorough examination and to submit a detailed estimate on necessary repairs in connection with the Ballintoy water supply. A report is also to be prepared on the Airds water supply.

Barnes U.D.C.—It is proposed to effect cable extensions for the supply of electric power, at an estimated cost of £1,000, providing the capital is found by the applicant company.

Bridgnorth T.C.—It is proposed to replace with 3-in. pipes 210 yds. of a 2-in. water main which has become corroded.

Carmarthen T.C. — The town clerk has been instructed to write to the local Members of Parliament on the question of promoting a Bill to relieve local authorities from the charges for electricity where the current is not consumed. It was stated that the town council had to pay the account of the electric light company although they got little or no light consequent upon the extinction of all public lights two hours after sunset.

Clackmannan C.C.—It has been decided to extend the water supply from the Inchna Burn at an estimated cost of £5,000.

Hampstead B.C.—A new feeder cable is to be laid to High-road, Kilburn, at an estimated cost of £2,929.

Liverpool T.C.—In view of the further extension and addition of factories in Liverpool, the enlargement of the electric generating station will shortly come before the city council. The wisdom of preparing to meet every demand for electrical energy is being strongly advocated in committee.

Margam U.D.C.—A sub-committee has been authorised to go into the question of a water supply to new works at Port Talbot Docks.

Plymouth T.C.—It is proposed to incur an expenditure of £737 for electric cable extensions.

Selby U.D.C.—A scheme has been sanctioned for a water supply extension estimated to cost £4,000.

Stalybridge T.C.—It has been agreed to instal a crude benzol recovery plant at the gasworks.

Sunderland T.C.—A scheme for extension of the electricity plant and mains, at an estimated cost of £46,696, has been approved subject to the Local Government Board and the Treasury sanctioning a loan for the works.

Swindon T.C.—A scheme has been sanctioned for laying a 4-in. water main a distance of 1,300 yds., at an estimated cost of £682.

Weston-super-Mare U.D.C.—The council are making application to the Local Government Board under the Special Acts (Extension of Time) Act, 1915, for an order under that Act extending the time for compulsory purchase of lands for the purposes of the Weston-super-Mare Urban District Council Act, 1914, for the period of one year.

MISCELLANEOUS.

Chertsey U.D.C.—Owing to the Local Government Board's decision not to allow the urban council to meet certain expenditure by a loan, that body has increased the rate for the ensuing half-year in the Chertsey Ward by 6d. in the £.

Launceston T.C.—A resolution has been passed unanimously in support of the St. Albans Council's proposal in favour of the adoption of the decimal system.

Maldens and Coombe U.D.C.—Messrs. Shand, Mason & Co. have bought by tender the manual fire engine for £25, and the curricle cart for £10 10s.

Oldham T.C.—It was stated that, owing to the lack of labour, eight tramcars would be sent for repair to the United Electric Car Company, instead of being dealt with in the municipal workshops, and that the cost would be considerable on account of the high price of material.

Paignton U.D.C.—A resolution has been adopted in favour of the decimal system of coinage and weights and measures throughout the British Isles.

Sheringham U.D.C.—The surveyor, Mr. F. Hall-Smith, has been authorised to carry out departmentally the repair of the damaged groyne, at an estimated cost of £350.

Ferro-stone Glazing.—The demand for their patent ferro-stone glazing has increased to such an extent that the new board of directors of the Universal Concrete and Construction Company, Limited, have decided to restrict the business of the company to this, and, in order to emphasise the fact, the name of the company has been altered to "The Ferro-Stone Glazing Company, Limited." Improved machinery and methods have been adopted, and ferro-stone bars of lengths up to 18 ft. can now be manufactured, delivered and erected with the utmost dispatch. These bars can be fixed to either wood or steel; they are claimed to be weather-proof, damp-proof, and fire-proof, and to require no painting. They are particularly suitable for all classes of factories, warehouses, and buildings requiring either vertical or roof glazing. Mr. Alfred E. Drown, Assoc.M.Inst.C.E., is the managing director of the company, whose offices are at 20 Victoria-street, S.W.

PERSONAL.

Mr. T. H. Scott, Assoc.M.Inst.C.E., city engineer, Port of Spain, Trinidad, has been elected a member of the Royal Sanitary Institute.

Mr. N. Barnett-Weekes, Assoc.M.Inst.C.E., water engineer's office, Liverpool, has been elected a member of the Royal Sanitary Institute.

Mr. George Lapwood, highway surveyor to the Romford Rural District Council, who has been seriously indisposed has resumed his official duties.

Mr. M. L. Slattery, traffic assistant in the tramways department, London County Council, has been appointed general manager of the West Ham Corporation tramways.

Mr. Albert Plunkett (not Mr. W. B. Jones, as previously stated) has been appointed surveyor and sanitary inspector to the Bredbury and Romiley Urban District Council.

Mr. E. O. Robertson has been engaged as temporary assistant in the borough surveyor's department, Hemel Hempstead, in the place of Mr. H. H. Parkhouse, who has joined the Army.

Mr. Donald Smith, Dumbarton, has been appointed burgh surveyor, sanitary inspector, master of works, and surveyor to the Dean of Guild Court by the Dumbarton Town Council in succession to Mr. John Briggs, deceased.

Mr. G. Palmer, assistant county surveyor of Cornwall in charge of Nos. 1 and 2 districts, has been called up for military service, and the Main Roads Committee recommend as his successor Mr. A. Aitken, of Holywell, North Wales.

Mr. Fletcher T. Tutin, director of municipal housing for Liverpool, completed recently fifty years of service with the corporation, which he entered at the age of thirteen as an indentured apprentice in the borough surveyor's department.

Mr. C. M. Walter has been appointed engineer-in-charge of the Industrial Research Laboratory in connection with the Birmingham gas department, at a salary of £400 a year, and Mr. Victor E. Green, assistant engineer, at a salary of £325.

Mr. Robert Craig, who is no longer equal to the duties of the highway surveyorship, has been appointed assistant highway surveyor to the Bromley (Kent) Rural District Council. The question of appointing a new highway surveyor will be considered shortly.

Mr. Vincent Smith, borough surveyor of Chesterfield, who at the outbreak of war rejoined the Army as Lieutenant in the A.S.C. and subsequently was promoted to the rank of Captain, was gazetted Major on October 7th. Major Smith's duties have been performed in the Eastern theatre of war, first in the Dardanelles and latterly in Egypt.

Mr. C. H. Roberts, water engineer to the Aberdeen Corporation, was recommended by the Water Committee for a grant of £300 for his services in connection with the Dee Water Supply Provisional Order, but upon a division the amount was, by a majority of one, reduced to £200. The proposal to pay time-and-a-half to the water engineer's staff was agreed to.

Mr. W. Harpur, city engineer of Cardiff, who has been to see his wounded son Sergeant Frank Harpur, of the London Regiment, has taken back an interesting relic—namely, a metal shaving mirror in a case, which Sergeant Harpur had in his left breast pocket when he was wounded. A piece of shell was found in the pocket, it may be assumed that the mirror saved him from a very serious wound, if not from death.

In his report to the session 1915-16, the president of University College, Cork, mentions that the Committee of the Privy Council for Scientific and Industrial Research has decided to make an allowance of £100 to enable Mr. William Kingston to receive a year's training in research under Prof. Alexander. Mr. Kingston will continue the work on concrete and reinforced concrete that he has been doing for the past year in conjunction with Mr. Johnson, lecturer in civil engineering. This is believed to be the first grant of the kind to a student in an Irish college or university.

OBITUARY.

Mr. C. T. Dennis, surveyor to the Commissioners of Sewers for the Louth, Navan and Spollaby districts, has died, we regret to note, as the result of a motoring accident at the age of sixty-one.

MUNICIPAL SCHEMES AFTER THE WAR.

Beaconsfield U.D.C.—Private street works, a housing scheme, and the putting in of hydrants.

Bridgwater R.D.C.—The statement prepared by the surveyor, Mr. W. H. Cousins, of suggested works includes the construction of a proposed new road at Wembdon, at an estimated cost of about £8,000; an improvement of the main road between Bridgwater and Mezehead; a road improvement at Dame Withycombe Hill, at an estimated cost of about £250; water supply to the parish of Otterhampton, at an estimated cost of £3,000; and the erection of a proposed new isolation hospital.

Easby R.D.C.—It is proposed to build six workmen's dwellings after the war.

Middlesbrough T.C.—The corporation have forwarded to the Local Government Board the following list of works, which they hope will be put in hand in due course: Acklam-road corner improvement; Parliament-road into Newport-road, widening; Marton-road (old toll-bar road, now vested in corporation, Local Act, 1914), widening, paving and draining; South Bank-road (old toll-bar road, now vested in corporation, Local Act, 1914), paving, kerbing, flagging and drainage; Stockton-road (length in extended borough, 1 mile), main road raising and paving; West-lane and Acklam-road, arterial main road, widening, taking off corners, and easing gradients.

Oldham T.C.—The town clerk has been instructed to obtain the necessary information from each committee of the council, and by public advertisement in the case of private persons. The erection of a town hall was mentioned by a councillor.

Ouseburn U.D.C.—The extension of sewerage at Overland, Newton; extension of the sewer outfall; enlargement and covering in of the water storage; construction of a reservoir at Newton; and private street works.

Scarborough T.C.—The council have approved the report of a sub-committee stating that after the war precedence should be given to the housing of the working classes and town planning.

Truro T.C.—An electric lighting scheme and sewerage and sewage disposal works.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BOROUGH OF GODALMING.
BOOKKEEPER AND CLERK.

The Council require the services of a competent Bookkeeper and Clerk in the Surveyor's Department, at a commencing salary of £2 2s. per week.

Male applicants must be ineligible for military service. Some previous municipal experience is considered desirable.

Written applications, stating age and qualifications, should reach the undersigned not later than Wednesday, 8th November, 1916, accompanied by copies of three recent testimonials.

ALAN BROMLY,
Borough Surveyor and Water Engineer.

Municipal Offices,
Godalming.
October 18, 1916. (3,136)

WANTED—Temporary Assistant Surveyor ineligible for Army). Applications, stating age, experience, and salary, inclusive of travelling expenses required, together with copies of testimonials, to be sent to R. J. Knapman, Surveyor and Sanitary Engineer, Rural District Council Offices, Whiston, Prescot, Lancs. (3,135)

COUNTY BOROUGH OF WIGAN.
SUPPLY OF GRANITE SETTS.

The Corporation of Wigan invite Tenders for the Supply of 300 tons of Granite setts to the Tramways Committee. Particulars and Form of Tender may be obtained from Mr. A. T. Gooseman, Borough Engineer, Wigan. Tenders, endorsed "Granite Setts," to be sent to me not later than Wednesday, the 1st November next. The Corporation do not bind themselves to accept the lowest or any Tender.

WILLIAM HENRY TYRER,
Town Clerk.

Wigan.
October 18, 1916. (3,134)

Institution of Municipal and County Engineers.

MEETING AT WATFORD.—(*Conclusion.*)

A short discussion followed the presentation at the recent meeting of the Institution of Municipal and County Engineers at Watford of the paper in which Mr. David Waterhouse, the engineer and surveyor to the urban district council, furnished a description of the new water supply and other municipal works of that town. A portion of the paper was reproduced in last week's Surveyor, and the remainder, dealing with the new works of water supply, which are nearing completion, will be found on another page of this issue.

The President (Mr. J. S. Brodie) said he thought he was correct in saying that since 1901 the population had practically increased by about 50 per cent. That would be a record for even the go-ahead towns of Lancashire, where they were quite accustomed to seeing a desert one day and a town of 50,000 the next. It would, he thought, have been interesting to have had in the paper a table showing the increase of the rateable value. The increase of population was almost without precedent, and the progress in that respect was such that the town was within measurable distance of becoming a county borough. The question of water supply was, of course, of paramount importance in a town undergoing such rapid growth, and it was a proof of the wisdom of the local authority that they had taken matters in hand as they had done and made such ample provision for the future. He could scarcely say it was extravagant provision, for, in his view, they would have been justified in making even greater provision. It was always well in connection with water supply to look well ahead, because, as they knew, the question was one which in this country was becoming increasingly difficult as time went on.

Mr. H. T. Wakelam (Middlesex), after remarking upon the apparently low capital cost of the water scheme, having regard to the supply provided for, said it would have been interesting to have had the cost per 1,000 gallons of pumping and softening. The estimated cost of the new reservoir would also have been of interest. With regard to sewage disposal, the position at Watford seemed to be that, while they had provided themselves with a farm, they had no effluent to deal with. Had Mr. Waterhouse considered whether, instead of selling their destructor clinker, it would not be better to utilise that material in the carrying out of his £46,000 scheme of road reconstruction? Clinker was being used for road work at Cheltenham, Fulham, Hornsey and other places, and he thought Watford would be wise to give the matter their attention before proceeding with their scheme. Wood paving would, of course, be necessary in certain thoroughfares, but elsewhere, clinker, properly prepared, would be of enormous use. Tar-painting, he noticed, was being carried out at a cost of 1½d. per super. yard, and he would like to know whether the tar was applied by mechanical means or otherwise.

Mr. J. P. Bennetts (Harrow) said he saw no reference in the paper to the consumption of water per head, or to any regular system for the detection of waste. He could give an instance of a case where the installation of Deacon meters was instrumental in effecting a reduction of waste from 18 to 7 gallons per head per day. That was in connection with a gravitation scheme, but with a pumping scheme it was more important still. As to the sewage, he had noticed that, in addition to there being no effluent at the works, there was also no sludge to be dealt with. Did the charge of 13s. 6d. per foot frontage for making up private streets include everything except the sewers? [Mr. Waterhouse: Yes.]

Mr. E. Willis (Chiswick) remarked that there was a tendency among the younger members of the institution not to cover a sufficient area of study, and he thought that papers of the kind under discussion, if carefully read and digested, would be of great help to students coming forward for the testamur examinations. Proceeding to deal with a number of points in the paper, Mr. Willis observed that the arrangement by which the girders spanning the chamber in which the driving mechanism of the low-lift pumps was located were all rigidly connected to the girders in which the high-lift pumps were bolted, was an excellent one, and one that should be adopted wherever possible. He would like to know whether the flue-cleaning apparatus had been found thoroughly successful and efficient. With regard to the chemical examination of the water, it occurred to him that the nitrates were somewhat high. Was that due to the condition of the soil or rock from which the water was derived, or was it connected in any way with the absence of sewage effluent? At Aldershot and some of the places on the South Downs he thought there was a similar absence of effluent. The device by which the sludge was diluted was an exceptionally clever one. They had been told that the main sewage pumps were capable of lifting 1,000 gallons per minute against a total dynamic head of 84·15 ft. Would Mr. Waterhouse separate that and give the static head? The process of utilising the steam from the destructor was fairly recognised, but during the intervals the destructor was not at work steam came from the electricity works. What was the charge for that? He noticed that baths were provided for in the housing scheme. He had personally always been strongly in favour of every house having its own bath, but his experience had been that in very small flats the baths were put to uses other than that for which they were intended.

Mr. E. Young Harrison (Guildford) said he considered that both the council and their engineer were to be congratulated on the exceptionally good water scheme that had been prepared. Mr. Harrison proceeded to ask whether consideration had been given to the advisability of using reinforced concrete for the whole of the reservoir? In regard to the housing scheme, were the baths really appreciated? He was glad to see the town was making use of the steam from the refuse destructor, and in that connection it would be interesting to know the evaporation of water per pound of refuse and per pound of fuel, if auxiliary fuel were used. The destructor boiler, Mr. Waterhouse had stated, supplied steam for running the whole of the sewage pumping and air compressing plant, and was saving an annual coal bill of about £900. How was that figure obtained? Coming to the water undertaking, he considered the council had been well advised to adopt the continuous system of water softening in preference to the intermittent system. They would find it satisfactory in every way and cheaper. Had there been any trouble in connection with the use of meters, or was the softening so perfect that there was no deposit? Were washers provided free as a means of preventing waste? What was the amount of lime used per 1,000 gallons? Also what was the pressure of water required for cleaning the filters? Was the cleaning done in one operation, and what was the life of the filter cloths?

Mr. H. Collins (Colchester) inquired as to what depth the borehole was lined. He would have liked some details of the false bottom which was used for floating the tubes into position, and to know how this was removed afterwards; also as to how the grouting up of the annular space between the tubes and the chalk was done. As regarded the analysis of the water, were not the chlorine figures, as well as those of the nitrates, somewhat high? With reference to the destructor, was there sufficient heat value in the refuse at all times of the year for steam-raising purposes? [Mr. Waterhouse: No.]

Mr. L. P. Marshall (Rangoon) said he wished to ask what was the consumption per head of population allowed for per twenty-four hours. He noticed that the sewage discharge was 1,450,000 gallons, or 32·2 gallons per head. [Mr. Waterhouse: 35 gallons.] What was the ratio between the average and the maximum draw-off per hour? How many days' supply service reservoir capacity was to be provided for? What was the estimated cost of the 2,000,000 gallons service reservoir, including valves and connections, but exclusive of cost of land? It would be interesting to know why Lancashire boilers and not Babcock & Wilcox or Sterling boilers were installed. He presumed the old pumping plant would be retained as a stand-by in case of one of the new engines being laid off for repairs, and a breakdown occurring to the other, as there seemed to be no provision made for installing a third engine and boiler. With regard to the sewage ejector system, on what data was the system designed, and what was the maximum flow in gallons per hour allowed for? He noted that the

Willowlane electors were fitted with alternating gear. Could Mr. Waterhouse say what difference was made in the maximum number of discharges obtained per minute from the ejectors? The late Mr. Aolt in Rayleigh obtained the following results:—Ejector 19, without alternating gear, one discharge at 1.07 minutes; with alternating gear, one discharge at 0.60 of a minute. With reference to the destructor works, he noticed that the quantity of refuse destroyed was 26 tons per day, which with four cells worked out at 6½ tons per cell. This appeared to be a very small consumption if the destructor was working throughout the twenty-four hours at its maximum capacity. What was the maker's guarantee?

Mr. R. S. Henshaw (Wellingborough) inquired how often the ejector pistons were cleaned out. Was any portion of the water supply obtained from the vicinity of the sewage farm? In regard to private street works, why was Norwegian granite specified? Why not Leicestershire? [Mr. Waterhouse: We cannot get it, besides which the Norwegian is cheaper.]

Mr. P. T. Harrison (Wednesbury) said his experience was that baths were in the majority of cases appreciated by the tenants of houses in which they were installed, and he thought that as time went on they would be still more appreciated. At Cheltenham they guarded against their misuse by providing the tip-up variety. They had put up 144 houses, and had experimented with houses with and without parlours, and he could say without hesitation that in any future scheme they would not build houses without parlours. Of course, that was going to affect the cost, but with the increase of wages that was taking place in every building a week would not be of such importance to a man in the future.

Mr. H. V. Cutler-Bolton said he had been struck by Mr. Waterhouse's proposal to take steam from the electricity works when the destructor happened to be under repair. It seemed a rather doubtful expedient, because there might come a time when the electricity works could require all their steam for their own purposes.

Mr. T. Bowes (Herts) asked if paper was collected separately from the ordinary refuse? [Mr. Waterhouse: No.]

Mr. F. Roberts (Worthing), dealing with the question of clinker, said he had sold none of this material for years, except under pressure. All they had was used in making tarred clinker roads, of which they had about 13 miles at the present time. The colour was the worst part of these roads, but their wearing qualities was good, and they were doing very well, one road taking all the traffic from Brighton. The cost of cleansing was considerable, and the work could be done by the most feeble of their men, so that altogether, they were well satisfied with the results. The cost worked out at about 1s. 2d. per yard laid complete.

Mr. R. J. Jenkins (Portsmouth) having contributed some remarks upon the depth at which the water was pumped from the bore holes, the discussion was closed by the President, who, dealing with the comments made in regard to the absence of a sewage effluent, asked Mr. Waterhouse to state the distance from the borehole of the water supply to the farm. That, he thought, would satisfactorily dispose of any doubt as to the purity of the supply.

Mr. Waterhouse intimated that he proposed to reply in writing to the points raised by the various speakers. A copy of this is to be supplied to, and will duly appear in, The Surveyor.

WORTHING MEETING.

A meeting of the Institution of Municipal and County Engineers will be held in the South-Eastern District, at Worthing, on Saturday, October 28th.

Society of Engineers. At the ordinary meeting of the Society of Engineers to be held at the apartments of the Geological Society, Burlington House, Piccadilly, W., on Monday, December 11th, commencing at 3 p.m., two papers dealing with the sources of minerals and mineral ores required in the engineering industry of the United Kingdom will be presented for discussion. As the subject for discussion is of exceptional interest at the present time, and a large number of eminent engineers and metallurgists will be invited to attend, the Council have decided to throw the meeting open to the public by tickets, which may be obtained (gratis) on application to the secretary, 17 Victoria-street, S.W.

ROAD TARRING.

A SOMERSETSHIRE PROTEST.

At the meeting of the Somerset County Council last week Mr. Kidner raised a strong protest against the way in which roads were now made. Everything, he said, was now being done for the motorist, with the result that main and other roads were now dangerous to horses. He believed this danger was a handicap to the breeding and keeping of horses. Tarring sloppy road-dust was one of the crying evils of the day, and the county surveyor should take a turn on horseback over the roads he is making.

Mr. Baker and other members joined in the protest.

Colonel Kirkwood, replying, said the matter of tarring the roads had been well thrashed out by the council. The system had resulted in a considerable saving.

Mr. F. H. Pearse mentioned that a new process had been tried at Long Ashton. It had, however, proved most dangerous, a neighbour having informed him that forty horses had fallen on the road in a fortnight.

It was understood that the matter should have the attention of the County Works Committee.

GRANITE TAR-MACADAM ON CHESTER COAST ROAD.

Mr. William Jones, engineer and surveyor to the council of Colwyn Bay and Colwyn, has had practically the whole of the section of the Holyhead to Chester main coast road within his district laid with granite tar-macadam. The new tramway widening on the portion of the road leading to Old Colwyn, and the new tramway track and the margins thereto have been laid with the same material.

The whole of the work has been executed by the firm of Messrs. William Shepherd & Sons, Limited, of Rochdale, who, we understand, are now busily engaged in road construction work for the Government in various branches of the services.

Timber, Plywood and Woodwork.—We would direct the attention of our readers to the full-page advertisement of Messrs. C. Jennings & Company, of Pennywell-road, Bristol, which appeared in our issue of last week. The information given in the advertisement should be of the greatest value to all users of timber, plywood or woodwork. We understand that the firm is prepared to answer any questions relating to the materials of which particulars were supplied, or furnish prices delivered to any part of the world, either of goods mentioned in the announcement or of others not included in it. They inform us that they hold stock at their branches and warehouses at Portishead (South Wales), Leyland and Pembroke Dock, Leicester, Swansea, Hull, Liverpool, Manchester, Newcastle and other places, and will be pleased to receive inquiries.

Swimming-bath Water Purification at Motherwell.—The opening took place on the 5th inst. of public baths which have been erected by the corporation of Motherwell at a cost estimated at £10,000. The scheme was designed and carried through by Mr. A. Victor Wilson, Motherwell, and comprises, in addition to a large swimming pond, eleven slipper baths, foot baths, and sprays for use of bathers before entering the pond, together with office and lavatory accommodation. The swimming bath water is filtered, and the plant, which has been installed by the "Turn-over" Filter Company, 39 Chichester-street, Belfast, can handle the whole contents of the pond in less than six hours. The convener of the Baths Committee, ex-Bailie M'Kendrick, in declaring the buildings open, said that those present had a very good demonstration of what the filtration plant could do. The pond had been filled ten days ago with unfiltered water. It stood for some time, and owing to the dust and lime which found its way into it became so thick that it was quite impossible to see the bottom of the pond at the deep end. They, of course, intended to empty the pond and refill it with fresh water. The engineer in charge of the plant arrived, however, and advised them to leave the water so as to show what his plant could do in the way of filtering. They acted on his advice, and all could see the result in that fine pond of clear water.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have, we are informed by the secretary, Mr. Alfred R. Potter, been arranged as under:

Nov. 10.—"Town Planning in Wales, with Special Reference to the Development of Hilly Sites," by T. Alwyn Lloyd (member).

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., A.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Prof S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffries (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act, with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

FOREMAN AND STEAM ROLLER DRIVER. October 23rd.—Kingswood Urban District Council.—The Surveyor, Council Offices, Kingswood, Bristol.

SURVEYOR OF HIGHWAYS.—October 23rd.—Malling Rural District Council. £200 per annum.—Mr. Frederick J. Allison, clerk, West Malling, Kent.

ROAD FOREMAN.—October 24th.—Leatherhead Urban District Council. 38s. per week.—Mr. S. R. Drake, surveyor, Council Offices.

CHIEF ENGINEER.—October 25th.—Dublin Port and Docks Board.—The Secretary, Port and Docks Board Office, Dublin.

TECHNICAL CLERK.—October 28th.—Harrogate Water Committee.—Mr. Arthur S. West, water engineer and manager.

ASSISTANT COLLECTOR.—October 28th.—Harrogate Water Committee.—Mr. Arthur S. West, water engineer and manager.

CLERK.—October 28th.—Harrogate Water Committee.—Water Office, 7 Haywra-crescent, Harrogate.

SURVEYOR'S TEMPORARY ASSISTANT.—October 30th.—East and West Molesey Urban District Council. £100 per annum.—Mr. J. Stevenson, surveyor, Council Offices, East Molesey, Surrey.

SURVEYOR.—October 31st.—Littlehampton Urban District Council. £220—£300 per annum.—Mr. A. Shelley, clerk, Littlehampton.

SURVEYOR.—November 1st.—For the Justices of the Blackheath Division.—Clerk to the Justices, London County and Westminster Bank Chambers, 2 Church-street, Greenwich, S.E.

TEMPORARY JUNIOR ASSISTANT. — Somerset County Council. £80 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY CLERK.—Somerset County Council. £110 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

TEMPORARY DIVISIONAL SURVEYOR.—Somerset County Council. £115 per annum.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

CHIEF CLERK.—Public Health Department of the Devon County Council. £150—£180 per annum.—County Medical Officer, 14 Bedford-circus, Exeter.

ENGINEERING ASSISTANT.—Mr. H. T. Wakelam, county engineer, Guildhall, Westminster, S.W.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

SHEFFIELD.—November 7th.—For the erection of a fitter's shop, for the Electric Supply Committee.—The Offices, Commercial-street, Sheffield.

WIMBLEDON.—For a corrugated iron building having a floor area of about 2,266 ft., for the corporation.—Borough Surveyor, Town Hall.

Engineering: Iron and Steel.

BRIDGNORTH.—October 23rd.—For providing and laying about 210 yds. of 3-in. cast-iron water main, for the corporation.—The Borough Surveyor, Town Hall.

EGREMONT.—October 23rd.—For the supply of 500 yds. of 1-in. galvanised steam strength water pipes, and cutting trench, for the urban district council.—Mr. J. Cowan, surveyor, Town Hall, Egremont.

BARKING.—October 24th.—For the repair and painting of a bascule bridge, for the urban district council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

MANCHESTER.—October 24th.—For the supply of hard-drawn copper trolley wire, for the Tramways Committee.—Mr. J. M. McElroy, general manager, Corporation Tramways, 55 Piccadilly, Manchester.

BOLLINGTON.—October 31st.—For putting down a borehole, for the urban district council.—Mr. S. Knight, clerk, Council Offices, Bollington, near Macclesfield.

NEW ROMNEY.—November 1st.—For the supply of posts and wire fencing, for the corporation.—Mr. W. Lamacraft, town clerk, New Romney, Kent.

DORSET.—November 6th.—For repairing and widening the Creekmore Bridge, for the county council.—County Offices, Dorchester.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

TAUNTON.—For the supply of old cast-iron pipe, water or gas, or slightly defective new pipe.—Mr. T. Goldsworthy-Crump, district surveyor, Taunton.

Roads.

PETWORTH.—October 23rd.—For steam rolling and scarifying the roads, for the rural district council.—Mr. E. H. Staffurth, clerk.

LEWISHAM.—October 24th.—For the supply of ¾-in. crushed ballast, for the borough council.—The Borough Surveyor, Town Hall.

BEACONSFIELD.—October 25th.—For the supply of 1,000 tons of 2½-in. and 1½-in. broken granite, for the urban district council.—Mr. H. T. Smith, surveyor, Council Hall, Beaconsfield.

NORFOLK.—November 1st.—For the supply of granite for a year, for the county council.—Mr. W. W. Gladwell, county surveyor, The Shirehouse, Norwich.

MADRID.—November 7th.—For the construction and maintenance of granite pavements.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

WALLINGFORD.—October 25th.—For the construction of sedimentation tank, three storm-water tanks, a storm-overflow chamber, sludge pumphouse, sludge area, various lengths of effluent carriers and pipe connections, and levelling lands and other works, for the rural district council.—Mr. G. Midgley Taylor, Caxton House, Westminster, S.W.

BARCELONA.—October 27th.—For street drainage and sewerage works, for the municipality.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

ROAD MAKING.

REINFORCE CONCRETE ROADS WITH
EXPANDED METAL.

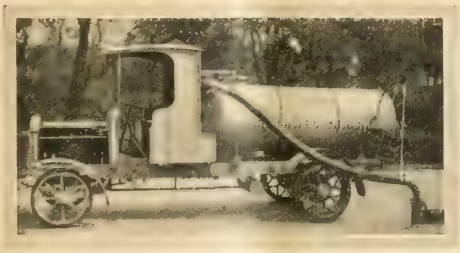
EXMOUTH SEA DEFENCE WORKS. Expanded Steel Concrete Slope and Roadway. Length, 1 mile; total width of Roadway, 65 feet
Mr. SAMUEL HUTTON, Urban District Council Engineer and Surveyor

THE EXPANDED METAL COMPANY, LIMITED
(Patentees and Manufacturers of Expanded Metal).
Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.
Works: STRANTON WORKS, WEST HARTLEPOOL.

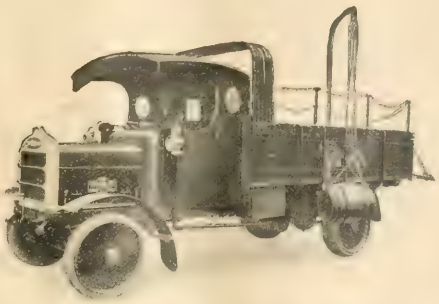
Straker-Squire

For

all types of Vehicles



This Petrol Motor Gully Wagon in the service of the Borough of Southwark is effecting a saving of 20 per cent.



5-Ton "Straker-Squire" Wagon supplied to Messrs. Bristowe & Co., of Westminster, S.W., for dealing with tar in barrels.

to suit PUBLIC WORKS requirements.

STRAKER-SQUIRE (1913), LTD.,
56—NELSON SQUARE—56
Blackfriars, LONDON, S.E.

Telephone: Hop 369 & 370.

Telegrams: "Rhomboidal, Friars, London."

Miscellaneous.

HERTFORD, October 21st.—For the supply of water fittings, brooms, shovels, and slop scoops, for the corporation. The Borough Surveyor, The Castle, Hertford.

WARRINGTON.—October 30th. For the supply of second-hand S.H. bags, for the Sanitary Works Committee.—The Manager, Longford Depot, Warrington.

RHONDDA.—October 30th.—For the supply of stoneware pipes, bass brooms, rotary brushes, picks, shovels, road scrapers, tools, iron castings, street gratings, manhole covers, paving, kerb, channel, pitching, Portland cement, macadam, granite road macadam, lime-stone macadam, and tarred macadam, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda, Wales.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

CORRINGHAM, ESSEX.—For new filter beds on behalf of Messrs. Kynoch, Limited, explosive manufacturers, Birmingham.—Mr. S. A. Hill-Willis, engineer for the works (by permission of Tilbury Urban District Council). Quantities by the engineers:—

S. E. Moss, Southend-on-Sea	£612
W. Iles, Southend-on-Sea	585
Horseman & Son, Grays	504
W. & C. French, Buckhurst Hill	471

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

OCTOBER.

20.—Institution of Mechanical Engineers: Paper "Trials on a Diesel Engine, and Application of Energy Diagram to Obtain Heat Balance"—by the late Lieut. Trevor Wilkins, M.Sc., to be presented by Prof. Burstall, Birmingham. Institution of Civil Engineers. 6 p.m.

24.—Institution of Civil Engineers: Sir John Purser Griffith, M.A.I., M.INST.C.E., on "The Development of Appliances for Handling Raw Materials and Merchandise at Ports and Other Large Centres of Traffic" (James Forrest Lecture). 5.30 p.m.

NOVEMBER.

10.—Town Planning Institute: Mr. T. Alwyn Lloyd on "Town Planning in Wales, with Special Reference in Development of Hilly Sites."

13.—Surveyors' Institution: President's opening address. 5 p.m.

DECEMBER.

8.—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.

APPOINTMENTS OPEN.

LITTLEHAMPTON URBAN DISTRICT COUNCIL.

SURVEYOR.

The Urban District Council require the services of a qualified Surveyor to supervise the Waterworks and Highways and perform the usual duties of a Town Surveyor. Applicants must be able to control and supervise workmen and keep proper accounts, prepare estimates, &c.; to devote whole time to the duties. Commencing salary £229, rising £10 annually to £300, with office provided, but no clerical assistance.

Applications, stating age, experience, and accompanied by copies of three recent testimonials, to be sent to me not later than 31st October, 1916.

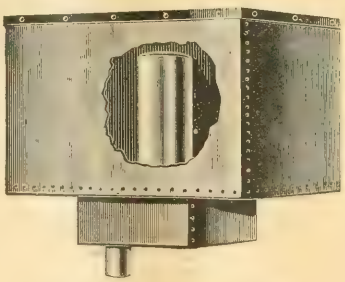
Personal canvassing will disqualify.

A. SHELLEY,
Clerk to the Council.

Littlehampton
October 16, 1916 (3,133)

TEMPORARY CLERK required (ineligible for military service); previous municipal experience desirable. Apply, giving full particulars of present employment and salary required, to the Surveyor, Erith Urban District Council. (3,129)

BRABY'S
AUTOMATIC FLUSHING TANKS.



SIMPLE. RELIABLE.

Illustrated Price List on application.

FREDK. BRABY & CO. Ltd., 352 to 364 EUSTON RD., N.W. IDA WORKS, DEPTFORD, S.E.

Security £6,349,479

LONDON & LANCASHIRE FIRE INSURANCE COMPANY LTD

FIRE.
Consequential Loss.
ACCIDENTS.
BURGLARY. MOTOR CARS
EMPLOYERS' LIABILITY.
MARINE.
Insurance against BOILER EXPLOSION and ENGINE BREAKDOWN.

Head Offices { 45 DALE STREET, LIVERPOOL. 155 LEADENHALL STREET, E.C.

Willcox's REQUISITES

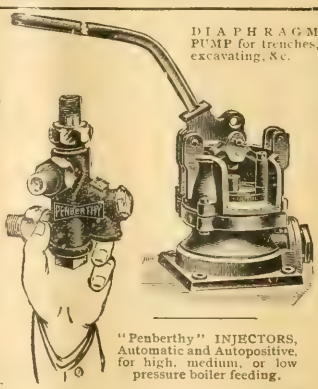
of every description, including Pumps, Hose, Water Lifters, Jointing for Pipes, Valves, Specialities as illustrated, and Road-roller Stores . . . . .

for Borough Engineers and Surveyors.

We can supply YOUR requirements promptly and at reasonable prices. . Write; 'phone, wire or call. A copy of our 736 pp. CATALOGUE will be gladly sent upon receipt of application on business form.

W. H. WILLCOX & Co., Ltd.
32-38 Southwark Street, London, S.E.

"Penberthy" Automatic CELLAR DRAINER for removing "flood" troubles.



DIAPHRAGM PUMP for trenches, excavating, &c.

"Penberthy" INJECTORS, Automatic and Autopositive, for high, medium, or low pressure boiler feeding.

The Surveyor

And Municipal and County Engineer.

Vol. L. OCTOBER 27, 1916. No. 1,293.

Minutes of Proceedings.

A Building Line Difficulty.

The object of sec. 3 of the Public Health (Buildings in Streets) Act, 1888, is, of course, to enable the local authority to exercise some control over the line of buildings in streets. It was apparent, however, from the first that the section is defective to this extent, that it does not enable the authority to fix a building line for the earliest buildings in a new street, and that these may really fix the line for the rest of the street. In addition to the difficulties arising from this inherent defect, others have from time to time arisen in the practical application of the enactment, owing to the interpretation which the Courts have put upon it in particular circumstances. In *Ravensthorpe Local Board v. Hinchliffe* (54 J.P. 421), for instance, a house (which we will call B) was in course of erection, its front main wall having been raised to a height of 5 ft. above the ground. On a site some 300 ft. or 400 ft. distant, on the same side of the street, another house (which we will call A) was commenced, and brought forward 6 ft. nearer the road than B. But it was held that the erection of A did not constitute an offence under the section for the following reasons—viz.: (1) That the words "house on either side thereof" mean a house "within some degree of proximity, and not one standing some considerable distance away"; and 2 that there was no front main wall of B in existence when the erection of A was commenced.

It would appear to result from this decision that a builder who wishes to evade the Act has only either to select a site at a sufficient distance from the house that fixes the building line, or to commence the erection of his building while that house is still in an incipient stage, and before its front main wall has been raised to a sufficient height to be visible to the eye of the law. It is true that it may not be always practicable to adopt either of these courses, also that the ruling is distinctly vague as to what distance will suffice on the one hand, or what height on the other. But it is within our knowledge that, for this very reason, it may sometimes be a source of considerable embarrassment to a local authority, especially as respects the latter point. In a case which has been recently brought to our knowledge plans were submitted of an intended building coming right up to the line of the street. At this time the nearest building on one side of the site was some 650 ft. distant; but plans had been approved of another intended building on the other side, some 40 ft. distant only, and set back 15 ft. from the street. Some short time afterwards the foundations of the latter building were put in, and its front main wall was raised at the corners to 4 ft. 10 in. and 1 ft. 8 in. respectively, though the intervening space was not filled in. In the meanwhile the month for approval or disapproval of the plans of the first-mentioned building had expired, and the local authority had passed a resolution, that they were of opinion that the bringing forward of the building to the street line would create a serious danger to the public, and requesting the owner to set back to the line of the second building—viz., 15 ft. Notice of this resolution was given to the owner; but, having regard to the decision in the Ravensthorpe case, it remains to be seen whether the Act can be enforced, however obvious it may be to the plain man that, *pace* legal technicalities, the proposed building would be conspicuously within the mischief aimed at by this enactment.

* * *

The Activated Sludge Process.

Although we understand that this process is now in operation on a large scale in two other places in this country, it is from Manchester, where it originated, that details as to the results obtained are published, and among the latest there are one or two features of considerable interest. It will be noticed from the extracts taken from the last annual report of the Manchester Rivers Department, printed on another page, that the possibility of effecting improvements in the design of the large tank, which has been in operation for some time, has been recognised and acted upon, and the results will be forthcoming in due course. We think it will be found that much can be done in this direction, particularly in the arrangements for settling out the matters in suspension in the final effluent and in the retention and removal of the activated sludge. Another interesting feature of the report is the description of the results obtained with a purely domestic sewage at the Withington works. It was obvious that the effect of the treatment by this process of the strong trade sewage at Davyhulme could not afford any criterion as to what effect it would have upon a more amenable sewage which does not receive trade wastes. It has always appeared to us to be one of the special advantages of this process that it could be adjusted without difficulty to produce a greater or lesser degree of purification as might be required to satisfy varying conditions at different places. It is now definitely stated that, if a highly nitrified effluent is not required, satisfactory purification can be maintained with a considerably less aëration period at consequently lower cost, and thus it is clear that in a number of places where the diluting water in the stream into which the effluent is discharged is of such a volume and quality that a highly nitrified effluent is not necessary, the degree of purification can be adjusted to meet the case. This is extremely important where the volume of water in the stream varies with the seasons of the year. During the few weeks in the year when the stream is at its lowest level the effluent can be purified to the highest degree, but during the rest of the year a great saving can be effected by reducing the period of aëration when the volume of water in the stream is high. In fact there is no reason, so far as we can judge at present, why

the period of aëration should not be varied exactly in inverse proportion to the volume of water in the river, so that the process would be controlled by the flow of water in the stream. We think it will be acknowledged that this would be the most scientific method of operating any sewage purification works, and that the activated-sludge process renders the adoption of such a method possible.

* * *

Water Supply and the Law.

Writing under this heading in our issue of October 13th, we were able to give some further particulars of considerable general interest in connection with the case of the *Metropolitan Water Board* v. *Dick, Kerr & Co.* We then intimated that the learned judge who tried the case in giving his decision said that he would give his reasons at length on a future occasion, and this he has now done. It will be remembered that the plaintiffs claimed a declaration that a contract for two reservoirs, which the defendants had agreed to construct, was still in existence, and that the defendants were bound to carry it out. They also claimed a declaration that they were entitled to certain plant and materials brought on the site of the works by the defendants, and they asked for an injunction to prevent their removal and sale. The defence was that the Ministry of Munitions had required the defendants to cease work, and that the contract had become illegal and impossible of performance, and was therefore at an end. The decision, already given, was to the effect that the contract was not abrogated, and that the materials and tools brought on to the site became the limited property of the board, to whom, however, the defendants were not bound to repay the proceeds of the sale, because in disposing of it they were acting as agents of the Ministry of Munitions. The first part of the decision was based on the principle, laid down by the House of Lords, that the proper thing to do in such cases was, as far as possible, to ascertain the intention of the parties from the terms of the contract itself. In this case his lordship was of opinion that the intention of the parties was to enable the engineer of the plaintiffs to extend the time for performance to every possible event which might delay the completion of the contract, including the intervention of the Ministry of Munitions. He also held as a fact that the contract had not been frustrated or its completion rendered physically impossible or commercially impracticable. The latter question was purely one of fact, and he did not consider that the object of the contract would be frustrated merely by delay caused by the length of the war. He held that the plaintiffs were entitled to the plant, tools, and materials on the authority of *Hart* v. *Porthgain Harbour Company, Limited*, and on the construction of clause 10 of the contract; but as to the proceeds of the sale of the plant under the instructions of the Ministry of Munitions he held that the defendants were not liable either to pay the proceeds of the sale to the plaintiffs or to pay damages for the removal of the plant, so far as they acted as the Ministry's agent, as he found they had done.

* * *

Eastbourne and its Street Trees.

The discussion at the Eastbourne Town Council on Monday on the proposal to remove a certain number of the trees in Devonshire-place raises a question upon which opinions are very much at variance. The suggestion was to do away with alternate trees in the street on the ground that they had been getting too thick, thereby shutting out the light. According to the mayor, medical men of experience had urged that "something should be done," and a councillor asked that the matter should be considered from the autumn view instead of the spring standpoint. Decayed vegetation, he said, in the form of fallen leaves was not conducive to health. It is easy to exaggerate this aspect of the matter, but all the same it must be conceded that autumn leaves need not be as abundant as in the Valley of Vallambrosa to constitute a nuisance, especially in wet weather. The point arises whether the nuisance of autumn is not more than set off by the serene benefits derived from trees in summer, more particularly a hot summer, when their cooling shade and pleasant appearance are always welcome. The medical and hygienic side of the question has its counterpart in the æsthetic, and this was duly voiced by several councillors with the enthusiasm which generally characterises the advocate of trees in streets. These maintained that it would be a great mistake to have it known that Eastbourne was not well off for trees, and it is possible that commercially this is a view that should not be lost sight of in the case of a seaside resort. In the end the town council seemed to set aside medical and æsthetic considerations alike by deciding to refer the matter to the arbitrament of the house owners and occupiers, who will, of course, give their votes according to the dictates of their individual likes or prejudices. It would surely be better if the controversy could be settled in some more authoritative fashion.

* * *

Engineering Education.

Although there have been those who have pinned their faith in the matter of engineering education either to college training on the one hand or to practical works training on the other hand, the soundest body of opinion to-day is certainly in favour of a judicious combination of the two. The abnormal length of the summer vacation in Scottish universities has rendered possible in that country a system by which students can attend classes in the winter and gain practical works experience during the summer months. But in England the division of the university year renders such a plan more difficult to arrange. We learn from the *Times*, however, that Dr. Wertheimer, the Dean of the Faculty of Engineering of the University of Bristol, has proposed a modified "sandwich" system of training. A student on leaving school will enter the university and will spend a session there, passing the intermediate examination for the B.Sc. Degree in Engineering at the end; if his record is good and he is a promising student, he will be recommended to a firm, which will allow him to enter their works for a period of fourteen months. This will enable the student to judge to what extent he is fitted for an engineering career, and will also enable the manufacturers to form an impression as to his suitability. He will then return to the university for a further period of two years—in some cases spending the long vacation in the works; after that he will return to the same works, if he has given satisfaction, for another period of fourteen months. Several engineering firms of high standing have already agreed to take part in the scheme, while others have the matter still under consideration.

* * *

Public Utility Societies.

Among the interests represented by the deputation which recently waited upon Mr. Long in regard to housing after the war was that of the bodies that have come to be known as "public utility societies." In considering the possible sources of supply of housing accommodation, it is sometimes forgotten that municipal schemes and private enterprise are not the only two alternatives. On the contrary, there are at the present time some thousands of acres of land under the control of public utility societies for which plans are prepared and upon which houses can be erected directly money, materials, and labour are avail-

ably. Speaking recently at a conference of the Central Committee, organised by the Garden Cities and Town Planning Association, Mr. Ewart Culpin rather complained that the work of these bodies was not receiving proper recognition. So far as we are concerned, we have for a long time past taken the view that the shortage of housing accommodation is so serious that there is plenty of room for every kind of agency which seeks to supply the need. Indeed, it was only last week that we wrote in support of a suggestion that private enterprise and not municipal building was the golden path to follow, experience has shown that to meet the demand there is plenty of room for the efforts of speculative builder, public utility society, and municipality, and even when all are doing their utmost some form of State assistance will be necessary to maintain the principle of the economic rent." We are sorry to observe now that Mr. Culpin apparently seeks to minimise the past efforts of municipalities. Surely, in view of the urgency of the problem, co-operation rather than co-operation should be the watchword of every and all agency.

* * *

House Refuse Utilisation.

In an article on this subject from the pen of Mr. Reginald Brown, which will be found in another column, the author discloses the principle of a new process which he has devised, and by which it is claimed that the full calorific value of house refuse can be made available for conversion into useful work. The process is described briefly as one of crushing, pressing, and impregnating. The crushing reduces the refuse to a powder, the presses convert the powder into briquettes, and the impregnating not only binds the material so as to facilitate handling, but also increases the calorific value of the fuel, and, what is more important, destroys all organic matter. If these claims for the new process be set against the known difficulties which at present stand in the way of heat utilisation, it will be seen that it at least contains possibilities of far reaching effect. What are these difficulties? First, in order to avoid nuisance, the material has to be got rid of as soon as it arrives at the works; secondly, the large bulk of ordinary refuse is not conducive to efficient combustion; thirdly, the refuse lies in the fire-bars in thick, loose layers; fourthly, an excess of air is required for complete combustion; and, finally, the refuse contains an excessive amount of moisture. By the simple process of immediate conversion into impregnated briquettes, which can be kept for any length of time, all these difficulties are done away with. The new process is said to be economical, because the refuse can be dealt with at a cost below the value of the finished article, and sanitary because entirely free from nuisance. It has already been exhibited in London, and will shortly be shown in Liverpool, Manchester and other centres, where no doubt many surveyors will take an opportunity of inspecting it.

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Municipal Officers and Military Service.

In the early days of July the War Office issued to officers commanding districts and recruiting areas a circular letter in which emphasis was laid upon the importance of maintaining as far as possible the efficiency of the work of local authorities and kindred bodies. The letter further contained a definite instruction as regards the professional, clerical, and administrative staffs, that those who were not fit for general service should not be removed from their employment without communication with the Director of Recruiting. A letter has recently been received by the National Association of Local Government Officers pointing out that the demand for men fit for garrison service abroad is now practically as great as that for men fit for general service, and that consequently the instruction contained in the circular letter above referred to has been modified. Municipal officers, and others to whom the instruction referred, who are classified as B1 (fit for garrison duty abroad), are now to be dealt with in the ordinary way, and the former instruction that they are not to be removed from their employment without communicating with the Director of Recruiting is cancelled. If, as must be assumed, this modification is necessary in the interests of the Army, nothing can be said against it, in spite of the further inconvenience that will be caused. The position in regard to men of lower classification than B1 remains unaltered, and they still cannot be taken without reference to the Director of Recruiting.

A Municipal Research Laboratory.

Some years ago a research laboratory was set up in connection with the gas department of the Birmingham Corporation, the general object being to bring to the notice of manufacturers the advantages of gas in connection with the various industries of the city. The experiment has proved so successful that the committee responsible for it are now suggesting an extension of its scope so as to make the laboratory one for general industrial research. In particular it is proposed to undertake the testing of metals and alloys, to make chemical analyses, and to make use of photo-micrographic apparatus. It is specially interesting to observe that this extension of the work is being made with the full approval and support of several trade associations. For the services of the laboratory it is proposed to charge in accordance with a scale of fees fixed so as to make the scheme self-supporting but not profit-earning. This establishment of an industrial research laboratory under municipal auspices is of peculiar interest just now, when such stress is being laid on the necessity for meeting foreign competition in the industrial domain after the war. The committee are so satisfied that this extension of the present organisation is necessary, that they have already given instructions for the purchase of the necessary scientific apparatus—which will cost approximately £2,000—and they now recommend the appointment of a staff with adequate technical qualifications.

* *

Reinforced Concrete and Covernment Departments.

A new illustration of the nervous attitude adopted by Government departments towards reinforced-concrete construction is afforded by the attitude of the Board of Trade towards the application of the Hove Pier and Kursaal Company, Limited, for consent to the construction of a pier at Hove under the Hove Pier Order, 1912. When the plans were submitted to the town council for approval they were passed subject to certain conditions, one of which was that the Board of Trade should be satisfied as to the method of construction by reinforced concrete. Upon application being made to the board in due course, the board replied that they were not in a position to express any opinion from the engineering standpoint on the question of the method of construction or of the sufficiency of the structure for the purposes intended by the company, who must accept all responsibility in that connection. We take it to be good law that the only question really relevant to the council's approval is as to whether or no the proposals before them are in accordance with the statutes and by-laws which it is their duty to administer. The Board of Trade, on the other hand, have to consider the matter from the point of view of the public safety, and it certainly seems to be a little curious that they find themselves unable to express an opinion on an engineering question which is no longer one of novelty and upon which expert advice is easily obtainable.

Ferro-Concrete Bridges in the Twrch Valley, Glamorganshire.

The group of bridges to which attention is invited in this article comprises four structures embodying the Mouchel-Hennebique system of ferro-concrete, which has been largely adopted in South Wales by county and district councils for the replacement of defective bridges and the improvement of traffic facilities. The four bridges described were built in the valley of the river Twrch, a tributary of the Tawe, which rises in the mountains of Brecon and flows along the picturesque Swansea Valley, entering the Bristol Channel at the seaport of Swansea.

Upper and Lower Brynmorgan Bridges.

A great and most desirable improvement has recently been carried out at Upper Cwmtwrch on the highway leading from Ystradgynlais in Breconshire and Ystalyfera in Glamorganshire to Brynamman, Llandilo, and other places in Carmarthenshire, by demolishing two old bridges at Upper and Lower Brynmorgan and building in their stead two ferro-concrete bridges on the Mouchel-Hennebique system.

Lower Brynmorgan Bridge.

The new bridges have a total width of 20 ft. 6 in. between parapets, providing a roadway of 17 ft. and a 3-ft. 6-in. footpath, and they have been arranged so as to enable inconvenient bends to be so modified that the obstruction formerly offered to traffic has been entirely removed.

The bridges were designed by Mr. Thomas Watkins, the surveyor to the Ystradgynlais Rural District Council, in accordance with the Mouchel-Hennebique system of ferro-concrete, working details of which were prepared by Messrs. L. G. Mouchel & Partners, Limited, of Westminster, and approved by Mr. J. Morgan, the surveyor to the Pontardawe Rural District Council. Messrs. Hobrough & Co., of Gloucester, were the contractors.

The upper bridge at Brynmorgan measures 85 ft. long on one side and 101 ft. long on the other side between abutments, and crosses the river at an angle of about 35 deg. The abutments are formed of three piers connected by a 6-in. face wall for the support of the main girders, which are of the continuous type, and are carried over two river piers, each 36 ft. long by 2 ft. wide. These piers, as well as the abutments, have extended footings founded on solid rock at uniform level, but at varying depths below the bed of the river.

In order to obviate the stopping of traffic during construction, the bridge was built in two longitudinal portions, one of which was completed as an independent structure and thrown open before destruction of the old bridge. The second portion was then undertaken and built so that the two halves are combined to form the spans of the bridge. The width of 20 ft. 6 in. between parapets would have given a much wider roadway than that ultimately adopted, but it was considered advisable in the interests of foot passengers to limit the width of the roadway to 17 ft., thus providing for a 3-ft. 6-in. footpath at one side of the bridge.

The spans consist of two exterior continuous girders, each 10 in. wide by 24 in. deep, and two centre girders of the same dimensions and type constructed in contact side by side. The girders are divided by the river piers into three spans of about 34 ft. each. The transverse secondary beams measure 5 in. wide by 14 in. deep, and the decking slab is 6 in. thick. This part of the construction is continuous, and acts as a general compression flange to the whole series of girders and beams. The parapets are monolithic, with the exterior girders, and the same feature is carried throughout the entire construction, thus conducing materially to its strength and rigidity.

The parapet is pierced, and all parts of the exterior surface are neatly finished, so that the new bridge constitutes quite an appropriate feature in this part of the Twrch Valley.

The Lower Brynmorgan Bridge crosses the river at an angle of about 30 degrees. Its length is 73 ft. between abutments, and its width is 22 ft. 6 in. from outside to outside of the parapets.

The main girders of the new bridge are supported at each end by three ferro-concrete piers connected by a 6-in. face wall in the same material, and intermediate support is afforded by a river pier, 32 ft. long by 2 ft. wide, founded in solid rock, at a depth of about 2 ft. below the bed of the stream. These piers divide the bridge into two 35-ft. spans.

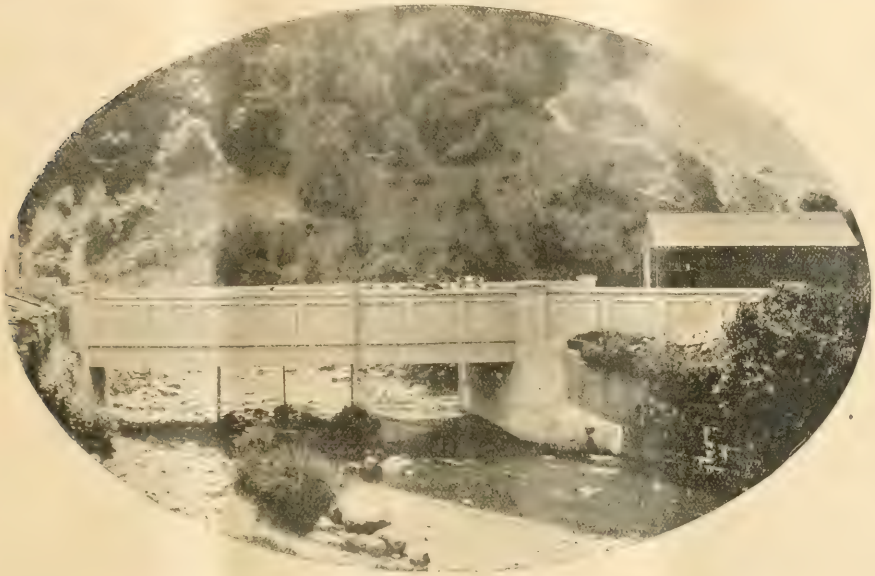
As in the case of the upper bridge, interference with highway traffic was avoided by constructing the span in two longitudinal halves, the first of which was opened to traffic before the demolition of the timber bridge, the roadway thereby provided

being approximately of width equal to that of the old structure. The construction of the second half would have given a roadway of 19 ft. 6 in., as represented in the cross-section, but it was decided to consider the safety of pedestrians by forming a footpath 3 ft. 6 in. wide at one side, thus reducing the roadway to 17 ft., nearly the whole width of flat ground available.

Each exterior girder measures 10 in. wide by 24 in. deep, and the centre girders are of the same dimensions, being placed side by side. The main longitudinal members are connected by transverse beams, 4 in. wide by 10 in. deep, and the deck slab is formed by a continuous [illegible] constituting a compression flange to the longitudinal and transverse members in each half of the bridge. The parapets, also constructed in ferro-concrete, are monolithic with the exterior girders, and the same jointless union exists between the span, the abutments, and the river pier.

UPPER CWMTWRCH BRIDGE.

A further manifestation of activity by the Ystradgynlais Rural District Council in the Twrch Valley is furnished by the structure known locally as the Lamb Bridge. It is situated at Upper Cwmtwrch, about a quarter of a mile above the Upper Brynmorgan Bridge, and takes the place of an old timber bridge formerly crossing the river Twrch.



Upper Cwmtwrch Bridge (Lamb Bridge)

Upper Brynmorgan Bridge

The general designs of the bridge were prepared by Mr. Thomas Watkins, surveyor to the Ystradgynlais Rural District Council, and approved by Mr. John Morgan and Mr. Evan Jones, the surveyors to the other contributory councils. Working drawings of the [illegible] construction were furnished by

Messrs. L. G. Mouchel & Partners, Limited, of Westminster, and the contract was entrusted to Messrs. Hobrough & Co., of Gloucester.

The new bridge is of the girder type, having a single span of 40 ft. between abutments and a width between parapets sufficient for an 18-ft. roadway, doubling the width of the accommodation provided by the old bridge.

LOWER CWMTWRCH BRIDGE.

The fourth bridge of the group described in the present article is situated at Lower Cwmtwrch, and known locally as Gilwen Bridge. This structure, also built throughout in Mouchel-Hennebique ferro-concrete, crosses the river Twrch in that part of Glamorganshire under the jurisdiction of the Pontardawe Rural District Council. The new bridge replaces a wooden structure which like others in the neighbourhood had become unsafe and unsuitable for modern highway traffic. It was designed in accordance with the Mouchel-Hennebique system by Mr. John Morgan, surveyor to the Pontardawe Rural District Council. Working details of the ferro-concrete work were prepared by Messrs. L. G. Mouchel & Partners, Ltd., of Westminster, and the contractors were Messrs. Hobrough & Co., of Gloucester.

The bridge comprises five continuous girder spans,

Lower Cwmtwrch Bridge (Gilwen Bridge).

one at each end of 17 ft. 1½ in., and the others of 17 ft. 9 in. from centre to centre of the supports, the total length being 87 ft. 6 in. between the abutments, which, with the exception of additional portions in ferro-concrete, are those previously carrying the old timber span. The ferro-concrete main girders measure 10 in. wide by 18 in. deep, and receive intermediate support from four river piers, each formed of two columns 15 in. square, rising from extended bases 3 ft. square, founded on solid rock about 4 ft. 6 in. below the river bed, the columns being connected by horizontal and diagonal bracings, 10 in. wide by 14 in. deep, as well as by the 7-in. by 16-in. transverse beams at deck level.

The two longitudinal girders are in monolithic connection with the parapets, a method of construction which has the effect of increasing the acting depth of the girders to 6 ft. 9 in., thereby adding enormously to the strength and rigidity of the work without additional expenditure. The decking system is completed by a continuous slab 5 in. thick, and on this the road paving is laid, the width being 15 ft. between parapets.

Stepney War Bonuses.—Stepney Finance Committee propose that, in order to meet the cost of living, war bonuses be granted to the employees of the council.

SEWAGE DISPOSAL AT SHEFFIELD.

TRADE WASTE DIFFICULTIES.

During the year ended March 25th last the total volume of sewage treated at the Sheffield disposal works was 8,590,690,000 gallons, the daily average being 23,471,830 gallons, or 48·02 gallons per head of population per day.

The records show a considerable increase in the volume of sewage, which is accounted for by the abnormal quantity of water used by industrial processes during the war, and by increased population.

The sewage has been distinctly stronger in character than previously, and particularly by reason of larger discharges of trade wastes, and additions to the number of water-closets. Treatment has in consequence been rendered more difficult, and constant vigilance has been required to prevent injury to the plant and contact beds by the trade wastes. Increased discharges of oily and acid wastes have been noticeable.

SLUDGE DISPOSAL.

In the annual report of the Highways and Sewerage Committee dealing with the work of the sewage disposal department during the period above-mentioned it is stated that the sludge produced amounted to 61,290 tons, representing 7·14 tons per 1,000,000 gallons of sewage treated.

The cost of the disposal of sludge was £5,697—equal to 22·31d. per ton. These figures are exclusive of capital charges.

The provision of further plant for the disposal of the sludge, in order that the amount of water which it now contains when conveyed to the tip could be reduced, has, the report adds, been under the consideration of the committee.

Mr. John Haworth, F.C.S., is the manager and chemist of the sewage disposal department.

Control of L.C.C. Tramways.—It is announced by the London County Council Highways Committee that on September 6th the Minister of Munitions issued a certificate that the supply of tramways facilities by the council's tramways department was of importance for the purpose of carrying on munitions work. The effect of such a certificate is that the undertaking will be subject to the provisions of Part I. of the Munitions of War Act, 1915, which prohibits strikes and lock-outs, and the provisions as to leaving certificates will apply to employees in the tramways department.

The Activated Sludge Process.

MANCHESTER RESEARCH WORK.

In the recently issued annual report of the Manchester Rivers Committee the progress of the research work in connection with the activated sludge process of sewage treatment is referred to at some length. Information of considerable value has, it is stated, been gained from the operation of the large-scale experimental tank that has been installed.

With the requisite amount of activated sludge it has been possible under certain conditions to maintain the efficient purification of the sewage by an average aëration period of four hours.

The area of the tank in question is 400 sq. ft., and it has been filled usually to a depth of rather more than 8 ft. The average four-hour aëration period allowed the tank to receive three fillings per day. In general, the water level was lowered 6 ft. on discharging, and in this manner 45,000 gallons of screened sewage were treated per day, with the production of a high-class effluent, capable of passing the dissolved oxygen absorption test of not more than 2·0 parts oxygen absorbed per 100,000 after five days' incubation at 18 deg. Cent., the test suggested by the Royal Commission on Sewage Disposal.

The prolonged operation of this tank has demonstrated:

(1) The advisability of filtering the air supply if diffusers are employed, particularly if it is liable to contain appreciable quantities of oil.

(2) The importance of adequate screening and detritus tank treatment of the sewage dealt with.

(3) That abnormal quantities of certain trade effluents interfere with the purification process, but that, generally speaking, the sludge fairly readily regains its activity if such discharges are not prolonged unduly.

(4) The possibility of effecting certain improvements in the design of the tank for securing economy in air expenditure, together with more efficient aëration and admixture of sewage and sludge.

The tank has now been reconstructed in the light of the experience gained during its previous operation, and has been re-equipped on the most up-to-date lines, with the view of ascertaining the minimum cost of the process under the best known conditions.

In order to investigate thoroughly the effects of certain trade effluents of an inhibitory character on the purification process, an experimental plant was brought into operation in July, 1915, at the Withington works, where a purely domestic sewage of less than average strength is received. For this purpose the 50-gallon casks in use at Davyhulme were transferred to the Withington works.

The aëration is effected through diffusers placed at the bottom of the casks, and means are adopted to obtain satisfactory circulation of the sewage and sludge.

The preliminary results obtained during the building-up of the activated sludge were so remarkable that it was decided to postpone the trade-effluent trials pending a careful investigation of the possibilities of the activated sludge process as applied to the purification of a purely domestic sewage.

The results of a fairly prolonged investigation may be summarised as follows:

(1) That, contrary to the opinion formed as the result of the earlier experiments when working with Davyhulme sewage (a strong trade sewage), the maintenance of the activity of the sludge, so far as complete removal of colloidal matter and satisfactory oxidation of the carbonaceous matter is concerned, is not dependent on the stage to which nitrification is carried. This means that if a highly nitrified effluent is not required, entirely satisfactory purification can be maintained with a considerable less aëration period, at consequently lower cost.

(2) That when dealing with a sewage free from inhibitory trade effluents the question of temperature is not so serious as was originally thought. Satisfactory purification was maintained throughout the winter months with air temperatures in some cases well below zero, and sewage temperatures of from 5 deg. to 10 deg. Cent.

(3) That the nitrogen content of the sludge is decidedly higher than that obtained from the sewage at Davyhulme. While the manner of handling the resultant sludge remains to be fully developed, the following analysis (mean of several determinations) supports the contention that it may be looked upon rather as an asset than as a somewhat serious liability, as is the case with present-day methods of sewage purification.

ANALYSIS OF WITHINGTON ACTIVATED SLUDGE (DRY).

	Percentage.
Loss on ignition	70·4
Mineral matter	29·6
Total nitrogen (as N.)	6·0
Total phosphoric acid (as P_2O_5)	4·2
Greasy matter (ether extract) ...	7·3

As a result of the discovery that the activity of the sludge was more or less independent of nitrification, two types of sludge have been built up, one a normal activated sludge in which nitrifying organisms are thoroughly established, the other in which no effort has been made to cultivate these organisms. For the purpose of differentiation, the latter sludge has been termed partially activated sludge.

These trials have all been carried out on the "fill-and-draw" system. For a period of several months casks containing 20 to 25 per cent of activated sludge have received four fillings per day, with an average aëration period of four hours; while tasks containing a similar volume of partially activated sludge have received six fillings per day, with an average aëration period of rather less than two hours—i.e., four fillings, one hour each, and two fillings, three hours each—the latter during the afternoon and early evening, when the sewage is at its maximum strength.

The following average analytical returns show that entirely satisfactory effluents were obtained in each case. In general, the effluents were exceedingly well clarified, and practically free from suspended matter.

AVERAGE ANALYTICAL RETURNS.

	Results in grains per gallon.		
	Screened detritus free sewage.	Partially activated sludge effluent.	Activated sludge effluent.
Four hours' oxygen absorption ...	2·12	·52	·41
Free and saline ammonia	1·58	1·20	·21
Albuminoid ammonia	·46	·09	·07
Nitrite (as NH_3)	—	·01	·01
Nitrate (as NH_3)	—	·40	1·33
Dissolved oxygen absorption, five days at 18° C., Royal Commission test	—	1·08	·63
No. of fillings per day ...	—	6	4
Average aeration period	—	1½ hours	4 hours
Volume of sewage dealt with daily	—	187 gallons	125 gallons

The results obtained have been so encouraging that it has been decided to instal a large-scale unit designed for operation on the continuous-flow system.

AERATION DIFFICULTIES: THE SHEFFIELD APPARATUS.

In the report of the Sheffield Highways and Sewerage Committee dealing with the work of the sewage disposal department of that city during the year ended March 25th last, reference is made to the difficulties which have arisen by reason of the choking, by dust from the atmosphere and fungoid growths, of the orifices and pores of the tiles used in connection with the supply of air necessary for the operation of the activated-sludge process. At the Sheffield works—where Mr. John Haworth, F.C.S., is the manager and chemist—an apparatus has been designed with the object of obtaining the necessary aëration without the use of porous media or small orifices, the necessary agitation being obtained by mechanical means. This apparatus has given encouraging results, and the Sheffield experiments, although only in their initial stages, have created wide interest among all workers engaged upon sewage disposal.

While it is yet too early to assume that the activated sludge process can be more economically applied than present systems, as there are difficulties

arising from the presence of trade wastes in the sewage and also with respect to modes of application of the air, the committee consider that the experiments are worthy of further development, and especially for the reason that, if the process can be satisfactorily applied, extensive areas of filters now required could be, to a great extent, if not entirely, dispensed with, and consequently valuable land could be set free for other purposes.

WHAT ARE GOOD DRAIN PIPES?

A TEST CASE: URBAN COUNCIL ACTION FAILS.

A test case on what are "good and sound" pipes for sewage drainage purposes was heard at the Croydon County Police Court on Saturday last, at the instance of the Carshalton Urban District Council. The defendants were Messrs. F. and G. Mizen, of The Culvers, Carshalton. They have recently erected new workshops, and were alleged to have committed a breach of the local by-laws in having failed to construct the drains of "good and sound pipes, formed of glazed stoneware, heavy cast iron, or other equally suitable material."

The drains, according to the evidence, connected the lavatories with a cesspool, in which work between 200 and 250 stoneware pipes were used. Mr. Lovelock (clerk to the council), who prosecuted, said it was admitted that these pipes were known to the trade as "seconds." In 1912 the manufacturers of drain pipes jointly came to an arrangement to brand all "seconds" with a black band. This was to indicate, in the terms of a circular they issued, that they were damaged or defective, and should not be used for foul-water drainage or sewage. As the circular could not be admitted as evidence, Mr. Lovelock produced later a memorandum of the Albion Clay Company (vouched for by a representative of the firm in the witness-box) which referred to certain quantities of "damaged or defective stoneware drain pipes, generally known as second quality, extensively used for surface-water drains." Expert viewers, according to the prosecution, classified the pipes after coming from the kilns, and the "seconds" were all faulty in one respect or another. There were such defects as lack of glaze, the projection of scoria (commonly called "burrs"), imperfect shape, the spigot improperly fitting the socket, and fire cracks. The "burrs" were in particular objected to as excrescences which, by arresting the flow of matter, might easily cause a stoppage of the drain. If "seconds" were allowed, Mr. Lovelock contended, it would revolutionise and make very difficult the work of public authorities in superintending drainage. The saving in cost between second and first class pipes (a witness put it at about 1d. per foot) was so little that "seconds" might at any time prove a very dear investment for sewage drainage purposes. Incidentally, Mr. Lovelock mentioned that there was a difficulty in getting manufacturing firms to attend and give evidence against their own customers.

Mr. W. W. Gale, surveyor to the council, said he regarded both London and country made "seconds" as equally contrary to the by-laws. If defendants' drain had passed a water test, it did not necessarily mean that no defects existed in it. He was greatly surprised to hear that in Croydon, Lambeth, and Bermondsey "seconds" were passed. He held that all drains, whether on a farm or in the street, should be of the best possible quality. In the absence of the black band he would have passed these drains after a water test.

Mr. Henry Ludlam, of the Albion Clay Company, said "seconds" were sold simply for surface-water drainage, and he did not consider they complied with the by-laws. He knew of no council which had passed "seconds" for sewage work. When his firm had the Bermondsey contract the goods supplied were of the best quality.

Mr. Robert Chart, surveyor to the Coulsdon and Purley Urban District Council, and Mr. Sidney F. Carter, surveyor to the Beddington and Wallington Urban District Council, each gave evidence for the prosecution.

Mr. H. T. Peard, for the defence, pointed out that only one witness had spoken as to the actual pipes in question.

All the witnesses for the defendants were of opinion that "seconds" were "good and sound" pipes within the meaning of the by-law.

Mr. Christopher Chart, F.S.I., surveyor, who had examined the pipes left over, said he would have no hesitation in using them himself, or passing them on behalf of a public authority. He had no personal knowledge of any local authority passing "seconds." Cross-examined, witness admitted that when concerned with sewage drainage work he generally specified pipes of first-class quality, because he did not think the saving was worth the risk. By that he meant the possibility later of having to change one of the pipes, the cost of which would be far greater than the original saving on the price. There was no risk if "seconds" stood the water test, as these had. Sometimes there was a doubt that they would.

Mr. G. F. Carter, borough engineer of Croydon, said the practice of his department was to give two water tests to ascertain whether it was a good job. They relied on those tests alone, without any concern as to the makers of the pipes, for one firm's "seconds" might be as good as another firm's "firsts." He knew "seconds" had been passed in Croydon, but could not off-hand give a specific instance. He did not consider there was any danger to the public health in doing that.

Mr. Henry Hemmings, of Nutfield-road, Thornton Heath, the contractor for the work, declared that the pipes were as sound as any he had ever seen. The witness gave instances of "seconds" being used in Croydon for house drainage. If he took the marks off the surveyors would not know the pipes. (Laughter.) Pipes were never fetched out for "burrs." It was through the cement left inside not being cleaned out.

The Bench dismissed the case, as it had not been proved that the pipes did not conform with the by-laws.

Mr. Peard asked for costs, but the chairman (Mr. Arthur Spurgeon) said he did not think it was a case for awarding them.

ROAD FOUNDATIONS IN BATH.

MACADAM REPLACING WOOD PAVING.

At a meeting of the Bath Surveying Committee recently, Mr. Sealy asked why macadam had been substituted for wood paving. It seemed that more work had been necessary than if wood blocks had been put down again.

The acting surveyor said a new foundation for the macadam would be necessary, but a new foundation of concrete would have been required if wood blocks had been laid again.

The chairman (Mr. A. Willis) said it had better be realised that right throughout the city the foundations of the roads were bad, and whenever they took up roads in the future they would have to reckon on putting a new foundation. The foundations were bad, and consequently the wood blocks did not wear as long or as well as they ought to. They had proved that when they went to various towns on a deputation, and recommended the committee to alter its policy with regard to foundations, and the committee was carrying that out.

Mr. Stone said that when the roads were laid in Bath they had not reckoned on the heavy traffic of to-day.

The chairman said no purpose was served in discussing the past; better accept the position and determine upon the right course for the future.

Conversion of Rubble Sewers at Sheffield. Of about 119 miles of stone or rubble sewers which were known to exist in Sheffield in the year 1898, over 98¼ miles have now been reconstructed.

Street Trees and Health. At the last meeting of Eastbourne Town Council it was recommended that in Devonshire-place, one of the finest roads on the South Coast, each alternate tree should be removed, as they prevented light and sunshine entering the houses. The mayor, Dr. Harding, in supporting the proposal, said the medical officer of health had recommended that the trees be thinned, while a similar letter had also been received from local doctors. Three West-end doctors visiting Eastbourne had expressed the same opinion to him. It was decided to take a vote of owners and occupiers of houses in Devonshire-place before removing the trees.

Institution of Municipal and County Engineers.

NORTH-WESTERN DISTRICT MEMBERS' VISIT TO CIVIC SURVEY EXHIBITION.

About sixty members of the North-Western District of the Institution of Municipal and County Engineers attended a meeting on Thursday, the 19th inst., held in Manchester in connection with the exhibition of the civic survey of South Lancashire. The members were received in the rooms of the Manchester Geographical Society by Mr. Shawcross, Prof. Abercrombie and Mr. Lodge, and other members of the Advisory Committee of Architects under whom the work in connection with the civic survey has been carried out. A very fine collection of plans was exhibited, and proved very interesting to the municipal engineers, though the methods adopted did not escape criticism in the discussion which followed the description of the plans. The plans of the Liverpool district were prepared under the direction of Prof. Abercrombie and those of the Manchester district under Mr. Lodge. Much useful information had been collected and was shown graphically on the various plans, and if it can only be published and circulated in a convenient form it will be greatly appreciated by municipal engineers.

The plan which evoked the most interest was one showing the road traffic in the Manchester district, on which the various kinds of vehicular traffic were shown in different colours, and the volume of the traffic was plotted to a scale of eighty vehicles per hour per inch. The horse-drawn traffic was shown in red, mechanically driven traffic in light green, and tramway traffic in dark green. This plan gave a very fine birds-eye view of the vehicular traffic of south-east Lancashire, but unfortunately it was not quite so complete or reliable as could be desired. It only gave the result of a census of traffic taken during the busiest hour of the day, and did not distinguish between light and heavy traffic. As was pointed out by Mr. J. S. Brodie, the president of the institution, and other speakers, this is too short a period to be of very great service to municipal engineers, and it led to a somewhat curious and misleading result. The traffic going north to Bolton and other places from the Manchester Docks is generally heaviest in the early part of the day and on the returns at a later hour, it is not possible to obtain the greatest amount of outgoing and returning traffic during the same hour. The plans consequently showed during the selected hour that the census was taken that the outward traffic was about twice that of the inward traffic to Manchester, though the volume of the maximum traffic would be fairly equal on both sides of the road, though at different hours of the day.

Another interesting plan showed the number of public and private open spaces in the Manchester area. Other plans showed the contours and rainfall of the district; the density of population to the acre, with the various classes of property and character of the ground in different colours; the accessibility of the different districts to the railway and tramways; and the growth and development of Liverpool from 1650 to 1895.

The plans were in several instances very finely drawn and coloured artistically, and the only serious criticism on them was that in a number of instances an attempt had been made to show too much on a single plan. The result was that some of the plans had over twenty different tints of colour to denote the different character of the buildings, open spaces, and density of population, and as a consequence it led to difficulty in distinguishing the character of the various plots, and caused confusion.

INCEPTION OF CIVIC SURVEY SCHEMES.

Mr. Shawcross, in welcoming the members of the institution to the exhibition, said the inception of the schemes shown upon the wall was due to London architects, who, finding their members badly hit by the war, formulated schemes for several centres to find work for a certain number of architects and their assistants. Six or seven met in Manchester and formed an Advisory Committee to decide upon the most useful form of work which they could carry out to relieve the distress in the architectural ranks. They did not get much help from the civic authorities, who thought it might land them into great expense, though they were wrong in this supposition. They first made the contour map and afterwards the traffic map. For the traffic map 1,350 counts of the traffic in the Manchester district were made, all of which were taken before the Petrol Order was enforced. The map showing the public and private open spaces was next taken in hand, and this had proved of great interest, though they only put down on the map what they found, and did not make any suggestions themselves as to what schemes should be carried out.

Prof. Abercrombie said that in Liverpool they had followed the suggestions, with some slight modifications, made by the London Society for their civic survey. They were both practically experimenting, and therefore in preparing the plans they had made several mistakes which they hoped to avoid in the future. Mr. Lanchester, who had done so much for town planning, had drawn up a scheme for London, which the French and Belgians proposed to adopt. In Liverpool they prepared plans dealing with the general topography of the district and its history; the static and dynamic factors showing the residential and industrial conditions, and of transportation and its relation to the width and character of the roads; the economic factors such as land values; and administrative control. When they first considered what work they should deal with, they thought they could revise the Ordnance maps, but they came to the conclusion that they had not the time, that their funds were insufficient for the purpose, and that their architectural training was not of the character required for making an accurate revision of these plans. They decided that, as the work was paid for out of a national fund, they ought to make a regional rather than a town or urban district survey. They therefore prepared the large-scale plan showing the roads and traffic between the large towns in south-east Lancashire. On the same lines they had shown the accessibility of the districts to the tramways and railways. Open spaces and the housing question were also dealt with in detail. They had been anxious to make these

PLANS USEFUL TO MUNICIPAL ENGINEERS,

and they invited them to offer suggestions for the improvement of the plans.

Mr. Lomax said that when they decided to make the traffic plan they thought they could utilise the counts of the traffic got by the Road Board, but they found that they were taken at such different hours, and on such a varied basis, that they were not of much use to them. They took one hour counts of the heaviest normal traffic during the day, avoiding race days and abnormal traffic, and plotted them on the plan to a scale of eighty vehicles per inch. They stopped taking the traffic at the outskirts of the large towns, for they found that in the towns there was a great amount of local traffic that they could not distinguish as outgoing or incoming traffic. The plan of the open spaces in the district showed that they had a number of golf courses of considerable area, which were invaluable from the health point of view. The rainfall diagram had been prepared on a fifteen-years' period, but they had since found that they should have taken it on a thirty-five-year basis. Accessibility to tramways and railways was shown by rings of ½ mile and 1 mile radius. The different densities of population were shown on another plan, and they found in places densities of over 200 persons per acre.

Mr. S. S. Platt (Rochdale), the chairman of the North-Western District of Municipal and County Engineers, said they were much indebted to the members of the Advisory Committee of Manchester Architects for inviting them to inspect these interesting and suggestive plans. Municipal engineers thought at first that the civic survey was going to entrench upon their work, but they had found that it did not do so. The road traffic plan on such a comprehensive scale was very useful, and suggested possibilities of ring and radial roads. There was great difficulty in relegating traffic to by-roads instead of running through the main residential roads. They wanted to divert the traffic from the centre of our large towns by providing ring roads on the outskirts. With regard to the plan showing the open spaces, he would suggest that every opportunity should be taken of keeping open the private open spaces for the use of the public. The municipal engineer must take the initiative

in town planning, but the architect could help considerably, and they should try to work hand in hand.

Mr. J. S. Brodie (Blackpool), president of the Institution of Municipal and County Engineers, said that he looked upon those valuable plans as a modern Domesday survey, and he would like to know how it was proposed to make this information accessible to municipal engineers. If pigeon-holed, the plans would not be of much use, but if readily accessible they would be of inestimable value. Counting the traffic for one or two hours during the day was not of much use to him. He wanted the twenty-four hours, and at a special time of the year. Blackpool had peculiar conditions, and he hoped that they would be able to extend their survey so as to include Blackpool.

Prof. Abercrombie explained that before they took the census they wrote to the surveyor in the district to ask him which was the most congested hour during the day, and the most useful time for the counting to take place. They were concerned with the greatest congestion, but surveyors wanted to know more about the wear and tear on the road.

Mr. A. M. Ker (Warrington) said he would like to know the kind of traffic as well as its amount—whether it was light or heavy.

Mr. C. Brownridge (Birkenhead) asked if the density of the population was obtained by actually counting or by an estimation. What was going to be the outcome of all this information? Much of it could be added to if Prof. Abercrombie would classify the methods on which he was proceeding. He had hung up his scheme in Birkenhead because he thought that unless they could get a common basis it would not compare correctly with other areas. An architect in a Liverpool paper has recently said that town planners were dreamers. He thought they were both

DREAMERS AND PRACTICAL MEN.

but some men were neither. We must have high ideals, and, though we might never reach them, we were still assisting in improving things.

Mr. E. Worrall (Stretford) remarked that the utility of these plans was a most important question. While each district could deal with its own roads it could not deal with the outside roads, but the county council had got the power and opportunity of providing communicating roads between important towns. They as municipal engineers not only wanted to know the volume of the traffic, but the character, so as to provide suitable pavements.

Mr. A. J. Price (Lytham) said that, while the plans were very successful artistically, they had attempted too much, and the great number of colours was confusing. The speed of the vehicle had a great deal to do with the congestion of the traffic, for congestion was generally due to slow-moving vehicles. He thought it would be very useful if plans could be prepared showing the position of the sewers, and gas and water mains, as required on the town planning plans.

Mr. A. P. Statham (Salford) said the traffic plan showed that the traffic was much denser on one side of the road between Pendleton and Manchester than on the other. In the morning they would find that the traffic was mostly going from Manchester, and it returned late in the afternoon. One hour's census was not sufficient, and if the plan had been correct it would be a mistake to have the tramway in the centre of the roadway, as the traffic would require a wide road on one side of the trams and a narrow road on the other—it would have to be a lop-sided road.

Mr. Horsfall asked whether the town council would provide a room where the plans could be kept, so that if small reproductions of the plans could be issued, persons using the small reproductions could inspect the larger plans and maps.

Mr. Smethurst said the exhibition had a value in giving them an ideal. It would be very useful and cognate to the subject if the plans could show the death-rate of the various districts. Congestion meant a high death-rate, and to go on as we were doing meant a high death-rate. Comparative death-rates put into graphic form would be very useful.

Mr. E. L. Morgan (Bolton) asked how we were to get rid of the traffic which went through our towns? Why should we not use by-roads, which would leave the central areas untouched? This could only be dealt with as a national question. We wanted a uniform scale of colours on the plans. He would like the open spaces near the rivers which could not be built upon shown on the plans.

Mr. T. S. Picton (Eccles) said that as the cost of preparing these plans came from the Prince of Wales' Fund, the work should be continued after the war, and be subsidised by the Government.

Mr. S. S. Platt (Rochdale) said he did not think the sewers and gas and water mains should be shown on the plans, as it would not be done accurately, and would have to be done over again.

Prof. Abercrombie said their efforts were largely experimental, and this was the first time they had been able to see them all together. The four Liverpool plans followed the London method, but he agreed that they would do better by producing this information on a larger number of plans. They had no funds for reproducing the plans, though they had been prepared with a view to reproduction. They were precluded from doing anything in the way of town planning; that must be left to the municipal engineers. He would like them to meet together from time to time, so that they could get their suggestions and ideas and embody them on the plans. They could draw out a sketch scheme for a colour scale, and they hoped to adopt Mr. Smethurst's ideas with regard to the death-rate and density of population.

Mr. Shawcross said anything they could give in the way of help to the Civic Survey would be welcomed, for anything that was done in the way of improvement must have the approval of the local bodies.

At the conclusion of the meeting the members were entertained to tea in the rooms of the Manchester Society of Architects.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

ANNUAL MEETING.

The annual meeting of the Lower Thames Valley District Surveyors' Association was held at the Town Hall, Twickenham, on Saturday last, and was well attended by the members.

The hon. secretary submitted a report which showed that excellent work had been done during the past year, and that the meetings had been very instructive and helpful to the members generally.

ELECTION OF OFFICERS.

The officers elected for the ensuing year are as follows—viz.:—

President.—Mr. J. G. Carey, Hounslow.

Vice-President.—Mr. F. Sadler, Acton.

Hon. Secretary and Treasurer.—Mr. G. Stevens, Feltham.

A hearty vote of thanks was passed to the retiring officers for their valuable services.

It was unanimously agreed that the usual annual subscription should be paid to the Orphan Fund of the Institution of Municipal and County Engineers, and in addition a special donation of £5 5s., in view of the probable heavy demands upon the fund as a consequence of the war.

After several interesting subjects had been discussed the meeting closed.

Society of Engineers.—At a meeting of this body, to be held at the apartments of the Geological Society, Burlington House, Piccadilly, W., on Monday, December 11th, at 3 p.m., two papers will be presented for discussion dealing with the sources of minerals and mineral ores required in the engineering industry of the United Kingdom. The first paper will be presented by Prof. W. G. Fearnsides, M.A., Sorby Professor of Geology at the University of Sheffield, and will deal with the minerals required by the iron and steel industries. The second will be presented by Prof. C. G. Cullis, D.Sc., M.I.M.M., Professor of Economic Mineralogy at the Imperial College of Science, and will deal with non-ferrous ores. As the subject for discussion is of exceptional interest at the present time, and a large number of eminent engineers and metallurgists will be invited to attend, the council has decided to throw the meeting open to the public by tickets, which may be obtained (gratis) on application to the Secretary, 17 Victoria-street, S.W.

HIGHWAY MAINTENANCE AT SHEFFIELD.

A YEAR'S WORK.

The gross expenditure of the Sheffield highways and sewering department (Mr. W. J. Hadfield, city surveyor) during the twelve months ended March 25th last was, we gather from the annual report of the committee, £153,649, as compared with £238,808 in the previous year. The expenditure on highways amounted to £38,877—£5,024 less than the sum voted.

It is pointed out that the reduction in highway costs is a saving only in part—much of it is due to postponement of capital expenditure. Broadly, the policy has been (1) to give great care to the maintenance of good roads (especially macadam roads), on the principle of "a stitch in time"; (2) to defer works of surface improvement where not imperatively necessary, and where practicable to repair worn roads instead of renewing them.

So far as the committee know, the error of "saving" in one year at a cost in the next year of perhaps twice or three times the amount "saved" has been avoided.

There are some directions in which a heavy after-the-war expenditure may be expected, principally in the renewal of wood pavements and the repaving of certain East-end thoroughfares, where the present traffic is abnormal; but this is work which could not be undertaken at present, and will cost less at a later date than if carried out at current prices.

The extent to which highway expenditure has been reduced will be appreciated when it is mentioned that while the figure for highway work was in 1912 £239, that for 1916 was only £111.

TAR-MACADAM ROADS.

During the year the length of tar-macadam roads increased from 55 miles to 60 miles, while water-bound or ordinary macadam roads decreased from 195 miles to 191 miles, the practice of the department being to lay tar-macadam wherever practicable in cases where water-bound roads fall out of repair. The quantity of tar-macadam used during the year was 10,677 tons—about half the usual quantity. Other macadam used for the repair of water-bound roads amounted to 3,711 tons—a total of 14,388 tons. This is 10,000 tons below the average—a reduction made possible without serious deterioration of road surfaces by the substitution in previous years of tar-macadam for water-bound, a work which has been greatly helped by the loan and grant received from the Road Board.

TAR-SPRAYING.

The tar-spraying of the remaining water-bound roads, as a table in the report shows, has been carried out to a greater extent than ever before, an area of 663,915 sq. yds. being dealt with, as compared with 483,526 sq. yds. in the previous twelve months.

Substitutes for calcium chloride are being tested on considerable lengths of hilly road.

ROAD BOARD SCHEMES.

Expenditure on these schemes up to March 25th last had amounted to £28,371, and it is now possible in some measure to realise what the financial effect of this work will be.

During the four years which have passed since reconstruction was commenced, £7,224 has been saved on maintenance charges—about 55 per cent of the previous cost of maintaining the roads in question—and this was during the period of conversion, when some of the roads still had to be maintained in the old way.

"This," says the committee, "is a very moderate way of putting it, as in the meantime motor traffic (for which the roads originally were not fitted) has increased, and maintenance costs must have gone up rapidly had the old form of construction remained. Experience in Sheffield shows that, by substituting tar-macadam for water-bound, not only do the public get far superior roads, free from mud in winter and comparatively free from dust in summer, but also that, although such roads are subject to an increasing amount of motor traffic, including some 'bus traffic, the latter being a new factor, they are cheaper to maintain than were the same roads under horse traffic when made in the old way."

EFFECT OF MOTOR TRAFFIC.

In order to illustrate the difference in traffic and its effect on road surfaces, mention is made in the report of the Redgate and Sandygate 'bus route.

A grant was obtained from the Road Board in the year 1913 for the purpose of constructing a tar-macadam centre along both roads, from Manchester-road to the Lodge Moor Hospital, in order to withstand the 'bus traffic. Between February, 1913, and March, 1916, in which months traffic returns were taken, the daily weight of traffic passing over these roads (the average effective width of which is about 7 yds.), calculated on the Road Board basis, had increased from 414 tons to 958 tons. The increase is due entirely to heavy motor traffic, horse traffic, in fact, having diminished about 33 per cent, while ordinary motor cars have remained at about the old figure. Even without the 'buses, motor traffic over this route would still exceed the total weight of all traffic when the previous census was taken. Although the tar-macadam strip generally has remained in good condition, the sides have suffered severely, and this was beginning to affect the tar-macadam. The worst parts of the margins have now been dealt with, and further sums are being included in the estimates from time to time for dealing with the remainder in the same way.

STREET CLEANSING.

In this connection the committee mention that the cost per mile of street per annum worked out at £106 6s.

Up to March 25th last the first motor sweeper had covered 12,200 miles, and the second 4,495 miles. At the end of the year a third motor sweeper was in course of construction, and the parts had been ordered for a fourth.

The introduction of motor sweepers has enabled the number of horse machines to be reduced from nineteen to about four.

TRAMWAYS PERMANENT WAY.

A considerable reduction of expenditure on the tramways permanent way is noted in the report, and there is an interesting paragraph dealing with the welding of rail joints. In March last the total number of welded joints was 6,876, of which 3,762 were electrically welded.

"This work," it is stated, "has been a great help in dealing with the old tracks which could not be renewed. Usually the joints wear out first, and the welding process has provided a practicable method of lengthening the life of track which otherwise must have been relaid."

THE STAFF AND THE WAR.

Up to March 25th last 294 foremen and workmen had joined the Forces and thirteen members of the office staff—total 307.

Messrs. Brierley (divisional surveyor) and Hassall (chief assistant, sewers department), both of whom enlisted as privates, have obtained commissions in the Naval Brigade—Engineering Division.

Notwithstanding the reduction in expenditure, the year has been a very busy one for the remaining staff. The amount of work done cannot be measured in money alone. Special calls have been made in many directions and have been met in a most willing manner by all concerned.

As an instance of extra work done the road making and drainage in connection with the munition colonies may be mentioned. The department was asked to carry out about 4¼ miles of road and 10,000 yds. of drainage work, as well as many miles of trenches for the gas mains, &c. This work was started late in December, 1915, and the drainage was practically completed by the end of March, 1916. In one week close upon a mile of pipes was laid.

St. Helens War Bonuses.—St. Helens Corporation have decided to give a war bonus of 2s. a week to single male and female employees and to married male and female employees without household responsibilities. To those with household responsibilities it has been decided to give a bonus of 2s. a week, with 1s. a week for the employee's wife and 6d. a week for each child.

Scottish Housing Commission's Report.—Replying to a question in the House of Commons on Tuesday, the Secretary for Scotland said he understood there was no prospect of a report from the Royal Commission on Housing in Scotland being issued before the date of the forthcoming Housing Conference at Glasgow. The work of the commission had been suspended for some time, but a proposal that the commission should be called together again for the purpose of its report was now before the Government.

Public Utility Societies and Housing.*

By EWART G. CULPIN.

Our public utility societies were represented in an important deputation which recently waited upon Mr. Walter Long in regard to housing after the war. Naturally it was but a part of the deputation, and the claim of the public utility societies as against public or private action was naturally not raised, and no reference was made to our work in the president's reply.

It is therefore necessary that we should consider the future from our own point of view and see if we ought not now to make some definite bid for increased recognition and for improved facilities. We ought to make it understood that we stand for a definite phase of housing reform, which is neither municipal work nor private enterprise; that we combine the good points of both these, and that we avoid some of the pitfalls of both; and that while we may at the same time be creating new possibilities of difficulties, we are at any rate alive to them and ready to meet them.

It seems to be agreed that the housing of the future will not be undertaken by private individuals unless there are very drastic alterations in legislation, both as to taxation and financial assistance, and it has been taken for granted that the only alternative to this is housing by local authorities. We have only to look at the figures of the number of houses provided by local authorities and by public utility societies during the past ten years to see that the new form of housing which we advocate is rapidly overtaking municipal enterprise.

MUNICIPAL HOUSING.

There is a more serious question. It is not everybody who is agreed upon the desirability of municipal housing, and, whatever may be our own opinions, we have to face this fact and to realise that municipal housing has been on many occasions—and probably will be on many more occasions—the subject of the rough-and-tumble of municipal elections, and for this purpose statements are made on both sides which sometimes have to be justified later on, to the detriment of housing schemes. That being so, it is the first argument why we should adopt a method of building and development which will not antagonise the opponents of municipal action.

Secondly, except in a very few cases, municipalities are not ready to proceed with housing schemes. After the battle of the booths a scheme has to be thought out in committee and in the council chamber; land has to be found, staffs engaged, plans drawn, and contracts entered into before a brick is laid. On the other hand, there are some thousands of acres of land under the control of public utility societies at this moment for which plans are prepared and upon which houses can be erected directly money, materials, and labour are available. It is too often the case that in regard to municipal housing schemes, owing largely to the disputes which are engendered, they are often either ill-matured or too slow in operation. Public utility societies consist, as a rule, of men who have given this subject special study, who have proper schemes and proper plans ready.

I suggest that municipalities can best help this work by securing land and forming roads, as has been done by Birmingham and Hereford, under sec. 5 of the Act of 1900. The land can then be leased to public utility societies, and if, as suggested later, increased powers are given for them to take part in the financial working of these societies, there are few parts of the country where work could not proceed.

Another reason why public utility societies will be in many instances better able to cope with the housing work than the municipality unaided is that as soon as peace is declared the municipalities will have an enormous amount of work to do. Schemes of urgent necessity which have been hung up in consequence of the war will have to be proceeded with; and, again, it may be necessary in many places for relief work to be started, and municipalities should be at liberty to undertake definite relief work which will not require so much preparation and elaboration as would a housing scheme. I think we can lay it down as definite that housing which is carried out as distress work is likely to be distress work first and housing second, and, so far as we are concerned, we cannot agree that this is the proper state of things. Where housing is required it should be provided entirely irrespective of the unemployment question.

THE GARDEN CITY STANDARD.

We should press always for what has come to be known as the Garden City standard of housing, which we may roughly, for this purpose only, define as follows:

(*a*) A definite lay-out plan must be provided capable of inclusion in a town-planning scheme, with due regard to open spaces and local amenities.

(*b*) The number of houses to the acre must be strictly limited, bearing in mind the circumstances of the neighbourhood.

(*c*) The work should, as far as possible, follow the Garden Suburb type on the outskirts of towns.

(*d*) Pending the adoption of a town-planning scheme the by-laws relating to roads and buildings should be suspended in regard to those clauses dealing with width and character of roads, height of rooms, space about buildings, &c., which prejudicially affect economical building and road construction—provided always that the structural and sanitary efficiency is in no way impaired by any such variations or suspensions.

But possibly the chief point where the public utility society will prove its superiority to either municipal schemes or private schemes is in regard to the social side, and this will be still more evident in rural schemes than in urban. It cannot, however, be neglected as a feature of suburban development, because I am certain that the lack of local patriotism is a very serious hindrance to civic development and to the fostering of a real civic spirit, while in rural areas the spirit of co-operation engendered by any such scheme of housing is likely to foster the growth of that "life" which we all agree is so essential for the future of our rural areas. The public utility society, with its village hall or its institute, is lifting housing on to a different plane. Men cannot live in bricks alone, and the development of the love of the real things that count can only be fostered as there are adequate facilities for mutual intercourse and common endeavour.

It is apparent that to do all this it may be necessary for a greatly increased amount of propaganda, and for the existence of a central society sufficiently strong financially to undertake the formation of societies and of sufficient standing and commanding sufficient ability to be able to act as a supervising and advisory body. Essentially this society must not be a trading concern, and I consider that one of the first things required to enable this work to be carried on is a moderate State grant to some organisation which could undertake this work. The functions of this suggested body would be many and varied, but if we are right in some of our surmises it will be necessary to have such an organisation, to which not only can individual societies turn for advice and assistance, but to which governmental departments can refer for particulars as to the standing and character of societies.

POLICY FOR FUTURE WORK.

Roughly, we have agreed upon a policy for future work, and without going further into argument I would briefly recapitulate this:—

LAND.

(1) Increased powers to enable local authorities to purchase and to own land, to develop it, and to lease it to public utility societies for the erection of dwellings.

(*a*) Land compulsorily acquired, as well as land acquired by agreement, to be available for leasing.

(*b*) Land to be available for all classes of property.

(*c*) Land leased to public utility societies for periods of 999 years (or "not less than 99 years") at ground rents which will be sufficient to cover repayment and cost of administration in 80 years.

* Paper presented at a conference of the Central Committee of Public Utility Societies organised by the Garden Cities and Town Planning Association.

The Surveyor
And Municipal and County Engineer

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(c) Local authorities to have first option to purchase property when a public utility society is dissolved or it desires to sell all or part of its land.

(2) Public utility societies to have power through some body charged with the duty to acquire land compulsorily for housing and town planning purposes.

MUNICIPAL P.U.S.

(1) Local authorities to have increased facilities for investing in funds of public utility societies.

(2) Co-operation with private investors and tenants to be effected in the following ways:—

(a) By purchasing and developing land and leasing it to the societies on favourable terms—eighty years repayment.

(b) By investing in shares of societies and making loans to them. This may be done in the following manner:—

(1) Local authorities to borrow from Government on favourable terms on security of rates.

(2) Local authorities to be able to advance 80 per cent by way of loan and invest not more than 10 per cent in shares or loan stock, or both.

(3) Remaining 10 per cent to be subscribed by tenants and other local investors.

(4) Management Committee to consist of eight members, five elected by local authorities, three by tenants and investors.

MUNICIPALLY ASSISTED SCHEMES.

Local authorities to have power to invest in societies not promoted by them up to one-third of the value of the property.

FINANCE.

Government money to be advanced on the following terms:—

(1) Nine-tenths of total value by way of loan; repayment period—land, 80 years; buildings, 60 years, at lowest rate of interest conditional on Garden City methods being applied. Less favourable terms under ordinary conditions. Garden Cities Association, or some such body, to report as to whether schemes are satisfactory from Garden City standpoint. (It is also suggested that more favourable terms shall be granted to those societies where the tenant members share in the profits.)

(2) Conditions of loan:—

(a) Societies to be conducted according to Local Government Board regulations.

(b) Periodical audit by public auditors.

(c) Definition of term "working class" to be extended to include all persons insurable under the National Health Insurance Act.

(3) Above conditions not to be contingent on the existence of unemployment, the need for houses to be the main consideration.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is there not a good deal to be said in favour of Mr. Wickenden's suggestion, as set forth in THE SURVEYOR of September 15th, that surveyors should keep diagrammatic charts of the various works and other matters connected with their district, so that statistics can be boiled down into comprehensible charts? Could not this system be extended to many of our Government departments, where voluminous statistics are kept in such a manner that they are unreadable, and convey very little, if any, intelligence, even if an attempt is made to decipher them?

* * * *

Is it not to be hoped that the Departmental Committee which is now sitting to consider the past working of the Summer Time Act, or Daylight Saving Act as it is more popularly known, will hear evidence in favour of a continuance of this useful and highly esteemed measure, as well as "witnesses as to any difficulties which have been encountered," which, a little bird whispers, is all the evidence they are going to take? Has not the Act been one of the most, if not *the* most, popular Act of Parliament which has emanated from the present Government?

* * * *

Is it not evidence of the enormous strides made in sanitation during the last century that the first filter for the purification of a public water supply was constructed about ninety years ago, and that now not only is water filtered, but in many cases is sterilised before consumption? Do we not find that the process of sterilising by means of ultra-violet rays, hypochlorites, ozone, and other sterilising media is being successfully applied, and may we not hope that, as "civilisation" proceeds to pollute our available sources of water supply, scientific progress will be able to meet the case by the introduction of economical and reliable means of sterilisation?

* * * *

Does it not strike one as being somewhat misleading for the public Press almost invariably to state, when dealing with some public improvement, that "the cost will fall on the council, or on the local authority," or that "the Government will bear the expense"? Would it not be more correct to say in the first case that "the ratepayers will be burdened with the cost," and in the second case "the taxpayers will have to pay for this"? Would not each individual then realise that he was paying his proportion, whereas now it probably does not occur to him in that light?

* * * *

Is it a fact, as stated in one of the dailies recently, that women are being trained, and turned out, as engine drivers in Schleswig-Holstein at the rate of fifty a month? and if this is so, why is it that the Metropolitan Commissioner of Police still refuses to grant licences to women as taxi-cab drivers? While on the one hand there is a cry for more and more fighting men and men for munition works, does it not seem remarkable that women should not be allowed to engage in an occupation for which they are quite suitable, and so relieve a large number of men for more important work?

* * * *

What was the reason for the road giving way at Birmingham the other day, when an electric generator weighing 34 tons was being transported to the corporation generating station? Should not a modern road way in a city be capable of bearing such a weight if properly distributed, unless some sort of cavity had formed under the crust or foundation? Would it not be very useful if in every case of failure, accident, collapse, or disaster, a full account of the cause could be made available for publication, so that a record could be kept of the circumstances which lead to such occurrences?

Leakage from Water-Pipe Joints.*

By F. A. BARBOUR. Chairman of Committee on Pipe-Joint Leakage appointed by the New England Waterworks Association.

On September 7, 1915—as a result of a paper read by Arthur H. Smith before the New England Waterworks Association—a committee was appointed "to investigate experience in the leakage of pipe joints." As the best method of obtaining the results of experience in joint leakage, a circular containing thirty-seven questions was sent to 430 members of this association and to 124 members of the American Waterworks Association. From the 554 circulars sent out 131 replies have thus far been received, forty-six of these being from the members of the American Waterworks Association.

One fact stands out: Even in the fully metered systems about 20 per cent of the total water supply is unaccounted for by sale to the consumers. Thus, of the 131 replies received, 10 per cent report the services to be entirely metered and 30 per cent more than 85 per cent metered, and the average water unaccounted for, as estimated in these systems, is 21 per cent. This loss is chargeable to leakage from mains or services, or to failure of the meters to register. It would seem to be worth while to attempt to locate the cause of a 20 per cent loss of the water furnished. If slippage of meters is the explanation, this simply means that consumers are getting more than they are nominally paying for; but if leakage from the mains and services is responsible, the result is an absolute loss of water, which costs money to develop and deliver to the distribution system.

If, then, in these fully metered systems, which undoubtedly represent the best conditions, only 80 per cent of the water supplied is sold to the consumers, the question arises as to whether this should be accepted as the highest standard of efficiency which can be reasonably attempted. If, in any considerable part, the unaccounted-for water is chargeable to slippage of meters, then it would seem desirable that increased attention should be given to the subject of maintained accuracy and sensitiveness of meters. If meter slippage is not the explanation of the unaccounted-for water, then the loss must be through leakage from the mains or services.

LOSS FROM SERVICES.

As to the loss from services, 80 per cent of those replying to the circular estimate this to be small or none. As to the leakage from mains, ninety-nine of the 131 answers received do not attempt to estimate this loss; eighteen state it to be very small or none; and fourteen estimate it in percentage of the total amount supplied, the average of these few figures being 15 per cent.

From the replies already received, therefore—and these presumably are from those departments best able to answer the several questions, or most interested in the problem—it is evident that while undoubtedly a considerable portion of the water supplied is not sold to the consumer, there is little or no definite knowledge of the actual conditions of the pipe joints. The general impression, as indicated, is that the mains are fairly tight, and that the leakage from services is small. It may also be inferred from various notes in the replies received that such leakage as may occur in mains is located at certain isolated joints, and is not general.

One phase of the investigation as conceived by the committee was that in reference to the practice of testing pipes when laid. Believing that in the majority of cases local conditions would not permit the trenches to be kept open until the pipes were tested, the question was asked as to the reasonable allowable leakage in testing after back-filling, as determined by the measured water necessarily introduced to maintain the test pressure. Such a method of testing is, of course, not to be compared with the visual examination of the joints under pressure, but it is necessary in many cases.

TESTING OF PIPE.

Of the 131 replies received in reference to testing pipe when laid, seventy-six state that such tests are made, thirty-six that no tests are attempted, and nineteen that sometimes the pipes are tested and sometimes not. The interesting and rather surprising feature in these replies is that all but six of those who state that the pipe is tested report that the test is made before back-filling the trench. Further, of the seventy-five who replied to the question as to the standard of tightness required before putting the pipe in service, sixty-three state this requirement to be "absolute tightness." Of those who report that it is customary to test the pipe when laid, 85 per cent state that the test is made under the working pressure which the pipe is to carry in service. Only eighteen report tests in excess of working pressure, the test pressures ranging from 30 lb. excess to double the working pressure.

From the information received to date it therefore appears that it is quite the general practice to test before back-filling, and to require absolute tightness under the working pressure. If these replies can be accepted as expressing the general practice of water departments, it is evident that the present standard is high, and the only question which might profitably be asked is as to what happens to the joints when the higher pressures due to water ram, and more or less incident to the operation of every system, are applied, and whether therefore pipes should not be tested at some pressure above that of working conditions. It is noticeable that but very few of the statements made in reference to leakage from mains and services are based on any actual tests after the pipes have been in use for any period of time, and the opinions expressed are generally formed from observation of such joints as have from time to time been exposed. Only four definite statements of tests for leakage of pipe after periods of use are reported, and these indicate only a small loss from the joints.

UNDELIVERED WATER.

Naturally, only those systems where a high percentage of the services are metered can make any accurate estimate of the water not delivered to consumers. Where less than 75 per cent of the services are metered, waste by carelessness inside the premises of consumers is undoubtedly the great factor in determining the amount of water supplied—a condition which clearly stands out in the replies received, by comparing the water furnished per capita with the per cent of metered services. Thus, with due allowance for special industrial demands, the relation between meters and amount supplied is approximately as follows:—

Per cent metered.	Gallons per day per capita.
100	68
75	75
50	90
25	110
0	125

It is therefore evident, as would be expected without the evidence of the present investigation, that, in the conservation of our water supplies, metering of the services is the great factor, and leakage from mains, except in particular instances, is of minor importance. While this is true, however, there remains the fact that in completely metered systems the average unaccounted-for water amounts to about 20 per cent of the total quantity of water delivered to the distribution pipes.

MORE INFORMATION NEEDED.

Whether it is economically possible to reduce this loss by a better type of joint, better workmanship, testing at pressures above the normal, cannot be determined by the evidence thus far made available to the committee. The information most needed to reach conclusions is that giving the results of leakage surveys, of actual tests made after the pipes have been in service some years, of experimental work showing the relation between pressure on the joints and leakage, and, particularly, data from those departments where accurate tests have shown leakage in mains to exist. There is no doubt that in many cases there is a large loss from the pipe system, even though in the replies received to date to the circulars of the committee the great majority regard this loss as very small, or refuse to make any estimate.

* From a paper presented at the annual meeting of the New England Waterworks Association last month.

IPSWICH TIPPING WAGON.

TWELVE MONTHS' WORKING OF ELECTRIC VEHICLE.

In a recently issued statement, Mr. J. R. Mead, the borough surveyor of Ipswich, furnishes an interesting account of the first year's working of an electric tipping wagon which he has adopted in his department.

"So far as I am aware," he says, "the corporation of Ipswich was the first municipality in this country to put into service an electric vehicle for general work in connection with the borough engineer's department.

"The vehicle, which was supplied by the General Vehicle Company, has a capacity of 3 tons, and is provided with a tipping body which is removable and arranged to give place, when required, to a cylindrical water tank having a capacity of 650 gallons, and provided with fittings for road sprinkling or gully and sewer flushing.

"As, owing to the war conditions, there was a delay in the delivery of the tank, which only came to hand during the past winter, no use was made of it in the year under consideration. The wagon has consequently been used entirely in the cartage of road material, &c.

"There has been plenty of work to keep it continuously employed. For the year ended March 31st last the vehicle had covered a total distance of 6,154 miles, and is estimated to have handled a little over 9,000 tons of various material. The following are the actual expenses incurred:—

	£	s.	d.
Garage (at the electric power station), fifty-two weeks at 7s.	18	4	0
Repairs, lubricants, topping up cells, &c.	4	14	0
Electric energy, 7,961 units at 1d., £33 3s. 5d., 10 per cent added to charges as from end of June quarter, £3 6s. 4d.	36	9	9
Wages of driver (6d. per hour plus war bonus) ...	7	16	8
Interest upon a capital expenditure of £958 10s. (wagon, exclusive of water tank) at 5 per cent per annum .	47	18	6
Allowance for depreciation on cost of vehicle, less cost of battery and tyres, £719 10s., on basis of ten years .	71	19	0
Renewal of tyres, on basis of 8,000 miles of life .	38	10	0
Renewal of battery plates on basis of two years' guarantee of makers	24	10	0
Insurance and driver's licence	5	14	8
Total cost per annum .	£396	16	7

"As to the allowance for battery renewals, we are told that upon our small annual mileage the 'Ironclad-Exide' plates will last more than two years, but as the makers' guarantee is for two years, and we have no previous experience to go upon, I prefer to err on the safe side by basing the renewals upon that period.

"In regard to tyres, it is fairly certain that had the vehicle been kept to 'made' roads the whole time a greater average mileage than 8,000 might reasonably be expected. As it is, the vehicle has had to run over roads in the process of making, and into the clinker yard at the destructor, which imposes very severe and destructive conditions upon rubber tyres.

"Our experience, after a year's use, is that this type of vehicle is very reliable, is economical, and—what is quite important in these times—is so simple to drive that any intelligent labourer or horseman can be taught all there is to learn in a few hours. Its handiness in negotiating congested streets and in manœuvring to loading and tipping places is a great advantage. Our experience is that the hand tipping gear is somewhat slow, and, moreover, cannot be operated by one man alone, so that it would doubtless pay to fit such vehicles with power-operated gear."

Heating and Ventilation.—A paper entitled "Heating and Ventilating Private Dwelling-houses," by Mr. C. T. Alfred Hanssen, ASSOC.M.INST.C.E., will be read at a meeting of the Society of Engineers to be held on Monday, November 6th, at 5.30 p.m., at Caxton Hall, Westminster.

MUNICIPAL SCHEMES AFTER THE WAR.

ALDERSHOT U.D.C.—The following schemes have been agreed to: Newport-road widening, £730; houses for working classes (50 to 100 houses), £13,000 to £23,000 (according to number of houses); Pavilion-road improvements, £1,200. Extension.—Plant (electricity station), £6,600; Ayling-lane and Church-hill widening, £700. Public Conveniences. — Wellington-avenue, £453; municipal gardens, £248; The Grove, £187; recreation ground, £288; Barack-road, £170; The Grove, £1,000. Elementary school, £7,500.

BLAYDON U.D.C.—Included in the schemes proposed is one for providing workmen's houses, at an estimated cost of £176,000.

DEWSBURY T.C.—The proposed expenditure includes: Health department, £30,422; highways, £12,272; sewage disposal, £57,490; corporate property, £2,500; tramway extensions, £2,015; electricity works, £42,300.

EASTBOURNE T.C.—The borough surveyor, Mr. A. E. Prescott, reports to the Pleasure Grounds Committee in regard to public works after the war as follows: "For the purpose of making a return to the Local Government Board, I suggest the following works can be carried out—viz.: Completion of the laying out of the Gilbert Recreation Ground, and construction of a model yacht pond, £5,000; the erection of ornamental shelters on Madeira-walk, £1,320; the laying out of a music garden and erection of shelter at the Redoubt end of the Parade, £5,000; a scheme for providing on the sea front improved shelter accommodation, and erection of new bandstand and shelters, &c., £10,000. It is to be understood that these schemes are only suggestions, the estimates being approximate and subject to revision." The committee have resolved that the above be included in the report to the Local Government Board on the understanding that the council do not pledge themselves to execute the works.

GRAYS U.D.C.—The Housing and Town Planning Committee have been authorised to prepare a scheme for the provision after the war of fifty houses, or more if necessary.

MALLING R.D.C.—The clerk, Mr. F. J. Allison, said the district roads would have to be made up. He also suggested the erection of cottages in the district, to which he believed the Government would make a substantial grant from Imperial funds. All their public buildings, the workhouse, cottage homes, and hospitals would need repair.

NORWICH T.C.—A report has been received recommending the extension of the municipal offices, and the carrying out of the Starling-road housing scheme.

ST. AUSTELL R.D.C.—The council have decided to schedule the following schemes: Mount Charles sewage farm, £2,500; St. Stephen's water and drainage, £7,000; St. Blazey and Tywardreath drainage, £10,000; Roche drainage, £2,000; Bugle sewage, £2,000; St. Dennis water and drainage, £4,000; Pentewan water and drainage, £1,000; houses for the working classes (Mount Charles), £6,000; new mains for St. Austell district, £1,000; county council for the maining of the St. Dennis and Par roads, £6,000 and £4,000 respectively; a new main road to Mevagissey and rural council new roads at Polken (St. Austell), and Whitemoor (St. Stephens).

SALTBURN U.D.C.—It is proposed to repair the sea walls and carry out street and sewerage works.

WORTHING T.C.—Among the works which the town council will probably schedule as necessary to be carried out after the war are the provision of more parade shelters, and additional public lavatory accommodation. The extension of the bandstand and sea front is a project which has been deferred, and may or may not be undertaken within a reasonable time after the war. The estimated cost is believed to exceed £10,000. The matter has been informally discussed in committee, but it is understood to involve an important matter of principle which will probably have to be considered by the town council in the near future.

Surveyors' Institution.—The first ordinary general meeting of the session 1916-17 will be held on Monday, November 13th, when the president, Mr. George Francis Stewart, will deliver an opening address. The chair will be taken at 5 o'clock.

Law Notes.

Edited by J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

Bridge Crossing. Highway.—"M. A. P." writes: It is proposed by a stone quarry firm to build a bridge over the public highway in this district. The land on both sides of the highway belongs to the firm. A plan has been sent in showing the width between the piers belonging to the bridge to be 20 ft., and the height from crown of road to underside of bridge 15 ft. The width, 20 ft. between the piers, is more than the width of the road where it crosses, the width of road being about 18 ft. The road is in a cutting, the height of the land on each side being 8 ft. or 9 ft. above the road level. What I wish to know is whether the council have powers under the Highway Act, or any other Act, to enforce the firm to make the width between the walls or piers 30 ft., being taken 15 ft. from the centre of the road, each way, to the walls for the bridge, and to enforce the height to be 18 ft. between the crown of road and the underside of bridge? I believe if the bridge walls were allowed to be built 10 ft. from the centre of the carriageway—that is, one on each side of the road—it would constitute an encroachment by making a building within 15 ft. from the centre of the carriageway. One side of the highway is in an urban district and the other side in a rural district. Are there any fees or charges of any kind which the council can enforce for such bridge crossing the highway? Some years ago the Birkenshaw Urban District Council made a firm of railway contractors pay a fee or charge for crossing a highway with a temporary bridge, when constructing a railway through that district, the highway there being in two districts, as in this case. The council charged, if I remember rightly, £100; but, whatever the charge they were paid, under what Act or power could the charge be made?

Inasmuch as the quarry firm are owners of the land on both sides of the road, they would be presumed to be the owners of the soil of the road, in the absence of any evidence to abut such presumption. Assuming that there is no such evidence, they would be entitled to build a bridge provided it causes no interference with the safety or convenience of the public passing along the highway. Unless the piers were erected on ground actually forming part of the highway they would not constitute an encroachment, even although they might be less than 15 ft. from the centre of the road. But if erected on ground forming part of the highway, and within 15 ft. from the centre thereof, the firm would be liable to penalties, and to pay the expense of their removal, under sec. 51 of the Highway Act, 1864. If it is necessary for the safety and convenience of the public that the bridge should be 18 ft. above the crown of the road, I think this could be enforced. Assuming that the firm are the owners of the soil of the road, the council cannot, in my opinion, require payment of any fees or charges in respect of a bridge over the road. Railway companies stand upon a different footing from that of private landowners. Under sec. 16 of the Railway Clauses Consolidation Act, 1845, a railway company, for the purpose of constructing the line, may construct temporary or permanent bridges over roads, subject to the provisions and restrictions in that Act and in their Special Act. It may be that in the case referred to the payment was made under some provision in the company's Special Act.

Highway Subsidence.—"W. J. G." writes: A public highway runs parallel for some distance to a river under the control of an agricultural drainage board. The metalled portion of the road is separated from the water by a grass-sloped bank, which slightly rises from the road for a width of about 4 ft. and then slopes down to the bottom of the river, about 12 ft. deep. In flood time the water rises nearly up to the top of the bank, and is therefore close to the highway. About twelve years ago a council authorised by a Parliamentary Water Act laid a water main in the road about 4 ft. deep on the metalled portion close to the river bank. For some time past there has been a gradual slipping of the bank for a distance of about 60 yds., causing a subsidence of the water main and a cracking of the metalled road along the line of the water main trench. The Drainage Board are seeking to make the council owning the water main liable for piling and making safe the river bank, contending that the bank has been weakened by the cutting of the trench for laying the main. (1) In your opinion, would the council be liable for making safe the bank, seeing that they had powers to lay the main in the public highway? (2) If not, is it the duty of the Drainage Board to make safe their own banks so as to protect the public highway and water main from subsidence; or is it the duty of the highway authority to protect their own road, and the council owning the water main their main, both of which could be done without interfering with the river bank?

Unless there is any clause in the council's Water Act imposing this liability upon them, I do not think they would be liable, in the absence of negligence, to make the bank safe. Whether it is the duty of the Drainage Board to do so would, I think, depend partly upon the terms of the Commission, Order, or Act of Parliament by which they were appointed, and partly upon whether there has been any negligence on their part. Assuming that the board is not liable, it is, in my opinion, the duty of the highway authority to do what may be necessary to keep the road in such a state as to be safe and fit for ordinary traffic, and it is the duty of the council to protect their main.

Building By-laws: External Wall.—"Bowler" writes: In my district the usual Local Government Board Model By-law in regard to thickness of walls is in force. This states that every person who shall erect a new domestic building shall construct every external wall and every party wall of bricks, &c., and where the wall does not exceed 25 ft. in height its thickness shall be as follows: If the wall does not exceed 30 ft. in length, and does not comprise more than two storeys, it shall be 9 in. thick for its whole length. I have recently received a plan of four houses, which shows a method of construction to which I have taken exception, as I do not consider the by-law referred to is complied with. A 9-in. wall is built between the houses in the passageway, and this wall supports the bedroom party wall above. This is quite in order. It is proposed, however, to construct the external walls of the houses in the passageway in brickwork only 4½ in. thick. The builder's contention is that this wall is not an external one. There are no doors at the end of the passages, and the drainage system is laid under the passageways. The entrance to the houses is not at the front, but out of the passage. Your opinion as to whether this wall is an external one within the meaning of the by-law, and whether it should be 9 in. thick instead of 4½ in. as proposed, will greatly oblige.

In my opinion this is an external wall within the meaning of the by-law, and should be 9 in. thick.

Infringement of By-laws.—"Yuys" writes: The Model By-laws with respect to new streets and buildings adopted in 1881 are in force in the district. A ratepayer made application in writing for the erection of a corrugated iron wash-house at the rear of his premises, which the council declined, inasmuch as it would be a contravention of Articles 11 and 19 of the said by-laws to consent to the erecting of corrugated iron buildings, and he was notified accordingly. The building, however, has been erected, and the owner has subsequently submitted a plan thereof. The wash-house has been built against an existing boundary wall, and I may add that previously a water-closet existed on the same spot. Will you kindly advise whether in your opinion the erection of the wash-house constitutes the erection of a new building to which the by-laws apply, and whereby the council are empowered to serve a notice upon the owner to remove the structure?

The wash-house appears to be a projection from the existing building, and therefore, if sec. 23 of the Public Health Acts Amendment Act, 1907, is in force in the district, its erection would be deemed to be the erection of a new building under that section. If that section is not in force, it is a "question of fact," for the magistrates to decide, whether its erection constitutes the erection of a new building. See *Jones v. Worrall*, 48 J.P., 725. In my opinion it is very doubtful what the decision would be.

Projection Over Footpath.—"September" writes: The upper portion of the windows to a newly erected house open outwards over the footpath, both in the

ground floor and in the storey above. There is power to prevent this. Has a statutory power to close the windows to open towards, under any Act?

There does not appear to be any statutory power enabling the council to require windows to be constructed so as to open inwards. But under section 28 of the Town Police Clauses Act, 1847, penalties are imposed on anyone who "places . . . any blind, shade, covering, awning, or other protection over or along a footway of less height than 7 ft. from the ground. The opening of a window so as to project over the footway at less than that height would appear to constitute an offence under this section. It applies to all urban districts, and also to rural districts in which it has been applied by order of the Local Government Board.

SALMON AND SEWAGE.

SEVERN AND WYE BOARDS' FEARS.

On May 1 at the Gloucestershire County Council it was reported that the Boards of Conservators of the Severn and Wye Fisheries Districts had written in reference to the proposed shipbuilding yards at Chepstow and the probable effect of the sewage resulting therefrom on the county.

The chairman (Mr. W. M. Colchester Wemyss) said sewage was one of the great industries in the county of Gloucester, though the Wye fisheries did not affect it much. It was feared that the sewage from the works might be injurious. A deputation had waited on the President of the Board of Agriculture, and his assurance was asked in the hope that the danger might be safeguarded. Unfortunately, the Public Health Act was apparently not applicable because these were tidal waters. All that the President of the Board of Agriculture could do was to promise to use his influence with the Board of Trade to secure a minimum of risk of injury. The chairman asked the council to support the two Boards of Conservators in any action that was thrown upon them.

Colonel Marling said that 4,000 or 5,000 workmen would be employed at the works, and at present no adequate steps had been taken to deal with the sewage from the works.

Mr. Gibbons said it was an important matter, as it might affect the Severn and the employment of a great many people in the fisheries.

The chairman said the Monmouthshire County Council had already joined the Severn and Wye Boards. He suggested that the council should write to the Board of Trade and the Board of Agriculture stating that they supported the conservators in their desire that [illegible] might be made.

Mr. Maclagan said that it was not to be expected that the [illegible] would be undertaken and works at Chepstow.

Colonel Nash said there was [illegible] the question as to the [illegible] the sewage [illegible] 4,000 or 5,000 men [illegible] going to be employed at the works.

The chairman's suggestion was agreed to.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐδ' ἀνήρ.

(One man does not see everything.)

EURIPIDES.

MECHANICAL STONE-BREAKING.

To the Editor of THE SURVEYOR.

SIR,—Owing to extra [illegible] in this district it [illegible] may have to resort to mechanical means of [illegible] macadam for main and district use. Our sole local product is flint, of which we [illegible] 17,000 cubic yards per annum, and not more than 1,000 [illegible] imported stone machine broken.

I have experience of the "knapping" breaker with whinstone and granites, but not of the rotary breaker, and not any experience of flint broken mechanically. My impression is that mechanically broken flint would be too severely fractured, owing to its brittle nature, to compare favourably with hand-broken flint.

Our flint, hand-broken, costs 1s. 4d. per cub. yard, but there is every reason to believe it will cost 1s. 6d. [illegible] to secure sufficient labour next year. I shall be pleased, therefore, to have other opinions of flint and its cost per cub. yard for [illegible] myself.—Yours, &c.,

ASSEX.

October 18, 1916.

EDINBURGH TRAMWAYS.

OVERHEAD SYSTEM RECOMMENDED.

The expiry of the Edinburgh and District Tramway Company's lease in 1919 has necessarily raised the question of replacing the existing cable system with a system capable of meeting the growing requirements of the city. In the circumstances the Tramway Committee of the corporation requested Mr. J. A. Brodie, Liverpool, Mr. J. B. Hamilton, Leeds, and Mr. A. Horsburgh Campbell, the burgh engineer, to report upon various questions, particularly whether it would be practicable to continue the cable system for any length of time after the expiry of the lease, and whether the electric system could be operated so that there would be no overhead wires in the central part of the city. Their report, which has now been presented to the town council, shows that there was possible of adoption electric traction by overhead, conduit, surface system, self-propelled cars by petrol and petrol-electric, and electric battery car, and motor 'buses. The principal cities in the United Kingdom which have adopted the overhead system are shown, including Glasgow. The system there is stated to serve a population of 1,150,000, with a mileage of 99·26, and showing a surplus per annum of £185,262. In mileage this is only exceeded by Manchester, but the surplus is less than that of Glasgow.

It is pointed out that overhead wires are no innovation in a city like Edinburgh, and that cities like York and Chester, and pleasure resorts such as Bournemouth and Southport, have adopted the system with good results, and that, it is thought, would be the experience of Edinburgh. As applied to the city they estimated that the cost of installation of the overhead system, restricted to the existing tramway routes, would be £400,000 in respect of street-work only, that was, for permanent way and electrical equipment of the tramway. The cost of installation would be somewhat reduced by the value of the existing foundation. The cost of installation of the conduit system, restricted to the existing cable routes, would be £850,000 in respect of street-work only.

In regard to the self-propelled car, it is thought that it would not prove a satisfactory or economic service for the entire city. Again, in regard to the motor 'bus, it might become a serviceable and suitable auxiliary to the tramway system. The reporters do not think it advisable or necessary to retain the cable for any route in the city.

In recommending the overhead electric system and dealing with the problem of the amenity of Princes-street, it is suggested that the conduit system should apply there from the Register House to the West-end. In the event of that being adopted, it is further suggested that an alternative line be provided in Queen-street to provide against the contingency of the conduit being affected by the influence of storm, &c. In a summary the report states that, independent of the existing tramway conditions of the city, the electric overhead system of traction offers the best, most reliable, convenient, and economical solution of the present requirements of the city and suburbs.

Street Watering in Camberwell. With respect to a complaint forwarded to the Local Government Board and by them conveyed to the Camberwell Borough Council, on the subject of restricted road watering, the Public Health Committee state that they have adjourned consideration of the two communications for the present, but are of opinion that the Local Government Board should be informed that the council, having in view the wish expressed by the board with regard to the question of economy and also the abnormal conditions prevailing owing to the war, did not provide in their estimates for Sunday or Saturday afternoon watering. It was not, however, deemed advisable to discontinue the watering of the streets altogether, the council being of opinion that this was absolutely necessary in market and shop centres. Further, the streets in the borough have been extensively tar-sprayed, approximately 60 miles having been attended to this year, and practically the whole of the macadam roads having been so treated during the last three years. In the opinion of the acting medical officer of health the chief danger from road dust as regards infant mortality arises from the contamination of milk by bacteria from horse excrement, and a very close watch is being kept in the borough to make sure that all milk exposed for sale is properly protected from dust.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Glasgow T.C.—The Electricity Committee have given general approval to the scheme for building a portion of the new generating station at Dalmarnock.

Norfolk C.C.—The Western Highways Committee have approved a proposal for rebuilding the Caston and Bodney bridges. They have instructed the county surveyor, Mr. W. W. Gladwell, to prepare the necessary plans, and have authorised the purchase of the steelwork for the superstructure.

HOUSING AND TOWN PLANNING.

Barnet R.D.C.—The Local Government Board have sanctioned a supplementary loan for the provision of workmen's houses.

Okehampton R.D.C.—The question of acquiring a site at Chagford for the erection of ten houses has been referred to the Housing Committee for report.

Walsall T.C.—The borough surveyor, Mr. John Taylor, has received instructions to prepare a scheme for the erection of 250 working-class houses.

MOTOR TRANSPORT.

Aberdeen T.C.—The Streets and Roads Committee have bought a second-hand steam wagon at £250.

Brighton T.C.—The chairman and the borough surveyor (Mr. H. Tillstone) have been authorised to visit a number of other towns with the object of reporting on the use of mechanical vehicles for street watering and refuse collecting.

Salford T.C.—A Foden wagon, fitted with jib-crane, has been ordered by the Highways Committee, at £700, and the Tramways Committee have purchased two Halley 2-ton motor chassis, at £558 each.

Stockton R.D.C.—Application is being made for authority to purchase a steam wagon for stone haulage.

Stratford-on-Avon R.D.C.—With respect to the proposed purchase of two traction wagons for £100, Mr. Day asked if it was good business to lock up capital in these trucks when they could be hired. Asked if it were intended to use the trucks in delivering the stone from the station, the surveyor, Mr. W. E. Coles, answered in the affirmative, and said that about 1,000 tons of haulage had not been tendered for. Mr. Taylor remarked that they had had some experience of this system at Henley, and they had saved a good deal of money. It would also find the workmen something to do in the summer. The surveyor said he estimated the life of the wagons at fifteen years. The council agreed to make the purchase.

REFUSE COLLECTION AND DISPOSAL.

Manchester T.C.—In the annual report of the Cleansing Department it is stated that the purchase of the Carrington and Chat Moss estates as an outlet for the refuse from the city has resulted in the transfer of 1,897,887 tons to the estates since their acquisition and the complete reclamation of the bulk of the moss land. The number of farm tenants on these estates is fifty-eight, occupying fifty-five farmsteads and three extensive nurseries. The market value of the land during the last few years has considerably increased, largely due to the proximity of the Ship Canal and the increased requirements of trade.

Wandsworth B.C.—The borough council have accepted the proposal of the British De-Tinning Company for dealing with metal refuse at the destructor depot at Tooting.

ROADS AND MATERIALS.

Aberdeen C.C.—The Aberdeen District Committee have approved the following proposals of the road surveyor, Mr. George Scott, for hiring plant and tools to the Road Board: Traction engine and two wagons at the rate of £2 10s. per day of ten hours; road rollers at 40s. per day of ten hours; engines to drive stone-breaking plant at 25s. per day (the above hire includes one man, coal, and other necessary outlays); wagon hired at the rate of 2s. 6d. each day; stone-breaker at the rate of 10s. per day; barrows at the rate of 1s. per week each; stone-breaker jaws at the rate of £12 per ton. With regard to other minor tools, these, it was stated, would be weighed before work was commenced, weighed again when work was completed, and the price per pound used would be charged against the Road Board.

Blackpool T.C.—One of the owners in Talbot-road having offered to give a strip of land for the proposed widening of that road, the Street Widening Committee have been authorised to approach other property owners with the object of furthering the scheme.

Brigg R.D.C.—The road to North Killingholme Station is to be repaired by the council at the cost of the railway company.

Brighton T.C.—It has been decided to remake the surface of the roadway in Queen's-road from Church-street to West-street.

Chislehurst U.D.C.—Repairs are to be carried out at Old Station Hill, at an estimated cost of £474, towards which the War Office will contribute £237.

Friern Barnet U.D.C.—The necessary notices have been issued for the repair of the part of Alexandra-road, in the Friern Barnet district, and it was reported that similar steps had been taken by the Wood Green council for the repair of their share of the road.

Fylde R.D.C.—The surveyor, Mr. T. H. Maxwell, has been authorised to purchase 600 tons of broken cobbles for the repair of the roads in Treales, Newton, and Clifton, and also 300 tons for the Westby roads.

Holme Cultram U.D.C.—The council have agreed to the purchase from the Blackpool Corporation of one of their latest type of street-watering vans at the reduced price of £18.

Lisburn R.D.C.—It has been agreed to increase the wages of the surfacemen on the main and district roads from 17s. to 18s. per week.

Mansfield T.C.—It is proposed to effect an improvement at the junction of Chesterfield-road and Cock-lane, at an estimated cost of £90.

Martley R.D.C.—The surveyor, Mr. H. L. Richardson, has received instructions to prepare a report on the cost and other details of tar-painting the roads.

Newton Abbot U.D.C.—The Sanitary Committee have received instructions to consider the question of paving a further portion of the River Lemon.

Okehampton T.C.—The borough surveyor, Mr. D. V. Howard, has received instructions to paint some of the street lamps with luminous paint as an experiment.

Omagh R.D.C.—The council have rejected a proposal of the county surveyor that the limit of expenditure should be increased by £3,000.

St. Ives T.C.—The question of the continuation of the Wharf-road improvement has been referred to the council in committee.

St. Pancras B.C.—The repair with creosoted deal blocks of Grays Inn-road, from King's Cross to Cromer-street, was agreed upon by the council on Wednesday. The cost of the work will be £3,500.

Scarborough T.C.—The borough surveyor, Mr. H. W. Smith, has received instructions to prepare a report on the landslip on the north side.

Stanley U.D.C.—It has been decided to issue a poster calling attention to the council's by-law requiring occupiers to remove snow from the footway fronting their premises as soon as this may be conveniently done after a fall of snow.

Stockton R.D.C.—Application is being made for urban powers for the purpose of carrying out street works at Billingham.

Yarmouth T.C.—The borough surveyor, Mr. J. W. Cockrill, reported that nearly 15 miles of roads had been tar-coated at a cost of £1,751, towards which grants amounting to £635 were promised.

SEWERAGE AND SEWAGE DISPOSAL.

Bodmin T.C.—The borough surveyor, who is on service, but is at present stationed at Bodmin, wrote to the council stating that he had visited the sewage works, and he considered they were acting in a highly satisfactory manner. The final effluent dis-

[illegible] intercourse reached a very [illegible] and gave no cause for complaint. There were, however, several matters of minor importance which needed greater attention if the works were to be maintained in that high state of efficiency hitherto attained. With the letter Mr. Bass was sent a verbal report, and it was decided that the whole matter should be discussed in committee.

Buckingham T.C.—A recommendation has been submitted to the town council for the purchase of new engines and plant at the sewage disposal works, at an estimated cost of £500.

Hollywood U.D.C.—The question of extending the sewer seaward has been referred to the Finance Committee for consideration, and the surveyor in the meantime has been instructed to prepare a report as to the necessary work.

Holme Cultram U.D.C.—With respect to the application by the council for a loan of £1,000 for new sewerage outfall works at Silloth, the surveyor submitted plans of the proposed scheme, which were approved. His proposal is to adopt a modification of the system in use at Blackpool, where he had paid a visit of inspection.

Orsett R.D.C.—The council have approved a draft undertaking in reference to the sewer which is to be constructed by Messrs. Kynoch, and which runs under the Corringham light railway.

Stone R.D.C.—The surveyor, Mr. J. Blakeman, has made representations with respect to the condition of the Blythe Bridge sewage outfall, which is in the area of the Cheadle Rural District Council, and receives the Blythe Bridge sewage under an arrangement with the Stone Council. The Cheadle Council have been communicated with on the subject.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—The city electrical engineer and the inspector of lighting are preparing a report on a proposed scheme of improved street lighting.

Axminster U.D.C.—A special meeting of the council has been convened for the consideration of a proposed new water supply.

Bingley U.D.C.—With regard to the lack of a proper water supply for Harden, it was stated by the clerk that the urban district council could force the Bradford Corporation to provide water if they guaranteed them 10 per cent of the cost for three years. It was a financial question. It was further stated that the Water Committee were giving serious consideration to the matter. Meanwhile it was resolved to withdraw the proposed proceedings against certain Harden property owners in respect of nuisances, owing to the condition of the water supply.

Eastbourne T.C.—The electrical engineer has been authorised to attend a conference on the interconnecting of electricity supply stations.

Hackney B.C.—The scheme for linking up the electricity works has been approved, and will be proceeded with subject to the approval of the Board of Trade and the Local Government Board.

Lancaster T.C.—Plans for an enlarged water supply are to be prepared for the consideration of the Water Committee.

Mansfield T.C.—The Gas Committee recommend that the Treasury be asked to sanction a loan for the purchase of gas stoves.

Motherwell T.C.—Alternative schemes are being considered for transmitting gas from the Motherwell works to the gasholder at the Carfin works.

Penybont R.D.C.—A scheme, estimated to cost £200, is to be carried out for the improvement of the water supplies at Penybont and Coychurch Higher.

St. Germans R.D.C.—The reservoir at Tideford has been completed, and the water supply is reported to be satisfactory.

MISCELLANEOUS.

Hove T.C.—During the financial year ended March last the corporation reduced the public debt of the town by £13,000. No fresh borrowing was sanctioned. The total expenditure in local administration was about £8,000 less than in pre-war times. There was a large saving on public lighting and recreation grounds.

Norfolk C.C.—Drawings submitted by the county surveyor, Mr. W. W. Gladwell, for part iron and wooden direction posts have been approved by the Western Highways Committee. The custom hitherto to paint certain direction arms red is to be abandoned, and in future all arms are to be white, with black letters.

Slough U.D.C.—At the last meeting the chairman referred to the economies effected by the council during the past few years. They used refuse instead of coal for raising steam for sewage pumping, and turned the clinker into paving. They had thus saved £6,198 in relief of the rates. The saving of coal amounts to £3,600, and the saving of paving materials to £2,148. Disinfectants worth £400 have been made from refuse, and old tins realised £50.

Wandsworth B.C.—The borough council have passed a resolution expressing concurrence with the decimal system of coinage and weights and measures.

PERSONAL.

Mr. Edwin J. Sadgrove, F.R.I.B.A., has been elected president of the Society of Architects.

Captain Vincent Smith, A.S.C., who in civil life is borough surveyor of Chesterfield, has been gazetted Major.

Mr. F. T. Elliott, surveyor and sanitary inspector to the Wrotham Urban District Council, has been voted £20 a year as a war bonus.

The Rev. H. G. Baker has been appointed surveyor to the Budleigh Salterton Urban District Council, during the absence of Mr. J. B. Holden on military service.

Mr. Leslie S. Robertson, M.INST.C.E., secretary of the Engineering Standards Committee, who lost his life at sea while accompanying Lord Kitchener to Russia, left £10,945.

Mr. F. L. Morrison, late of the borough engineer's office, Islington, has been granted a temporary commission as Sub-Lieutenant R.N.V.R., for observer's duties with the Royal Naval Air Service.

Major W. H. Prescott is returning to his civil duties as engineer and surveyor to the Tottenham Urban District Council. He has been to the Front with the Royal Engineers, but has been in England some time now, following a fall from his horse.

Captain John T. Hines, R.E., who in civil life is city engineer of Port Said, Egypt, has been awarded the White Eagle, Fifth Class, by the King of Serbia for conspicuous services in the present campaign, and his acceptance of the decoration has been approved by H.M. the King.

Mr. L. G. Dashper, surveyor to the Sandown Urban District Council, has persuaded his council not to make an application for exemption in respect of himself, as he is anxious to join the Royal Engineers, and he will take up service on November 20th. The council have granted him leave of absence for as long a period as necessary, and have also decided to pay him the customary allowance.

Temporary Second-Lieutenant Thomas Higgins, R.E., engineering assistant in the borough surveyor's office, Leicester, has been awarded the Military Cross. His meritorious action is described thus in the *Gazette*: "He persisted in the consolidation of the captured trenches under intense shell fire. Later he volunteered to assist the infantry by carrying up material, and made several journeys through a heavy barrage."

Mr. James Diggle, engineer to the Heywood and Middleton Joint Water Board, on Monday last completed fifty years' service in connection with the Heywood water undertaking. At the meeting of the board an illuminated address was presented to Mr. Diggle by the board, and congratulatory addresses were given by the chairman (Alderman Bentley, of Middleton), Alderman T. Popple (Heywood, and the Mayor of Middleton (Alderman W. M. Wiggins).

Mr. R. G. Collinson, assistant borough engineer, has been appointed borough engineer of Swansea, in succession to Mr. R. H. Wyrell, resigned. Mr. Collinson, who was formerly in the office of the borough engineer of Rotherham, took up his duties some time before the outbreak of war. Early in the war he joined the Royal Engineers, and was subsequently awarded a commission as Lieutenant. The town council have decided to ask the War Office to release Mr. Collinson. The salary is £800 per annum.

Second-Lieutenant Rae Moir, of the Duke of Cornwall's Light Infantry, has received the Military Cross for gallantry and devotion to duty in the field. Lieutenant Moir is reported to have controlled a working party with great skill and courage, and to

have finally withdrawn his men across the open without loss. In civilian life Lieutenant Moir was engaged as an engineering assistant in Mr. George A. Hart's office on the sewage disposal scheme for the city of Leeds. He joined the R.A.M.C. (West Riding Division) as a private in August, 1914, and was engaged both at home and in Flanders in this branch of the service. He subsequently obtained a commission in the Duke of Cornwall's Light Infantry, and was drafted for service on the Western Front, as the result of which this distinction for meritorious conduct has been conferred upon him. Lieutenant Moir is a B.Sc., with Honours, of Birmingham University, and is a native of Montrose, N.B. Prior to joining the staff at Leeds he was engaged as an engineering assistant in the Leeds Corporation waterworks department at Leighton reservoir, and also upon railway construction in Chili. Lieutenant Moir is the second member of Mr. Hart's staff who has received the Military Cross, Second-Lieutenant A. W. Wilson, R.E., of South Elmsall, Pontefract, having received this distinction in May last.

In addition to the awards announced in April for papers read at meetings, the council of the Institution of Civil Engineers have made the following awards for papers published in the "Proceedings" without discussion during the session 1915-16: Telford Premium to Messrs. Hubert Mawson (Liverpool), T. W. Keele (Sydney), R. W. Holmes (Wellington, N.Z.), W. Fairley (London), J. M. Greathead (Johannesburg), T. C. Hood (Manmad, India), and J. B. Ball (London); the Manby Premium to Mr. W. C. Cushing (Pittsburg, U.S.A.); and the Crampton Prize to Major C. E. P. Sankey, D.S.O., R.E. (London). The Indian Premium for 1916 has been awarded to Sir John Benton, K.C.I.E. (Eastbourne).

KILLED IN ACTION.

Second-Lieutenant Humphrey Thorn was mortally wounded on the 13th inst. while gallantly leading his platoon of the 7th Battalion Norfolk Regiment in France. He was nineteen years of age, and the eldest son of Mr. Clifford and Mrs. Rose Thorn, of Gayton House, Norwich, and grandson of the well-known water engineer, the late Mr. John Ayris, M.INST.C.E., whose great ability Lieutenant Thorn inherited. He was an articled pupil of the city engineer of Norwich, who, with his staff and all with whom the late Mr. Thorn came in contact, greatly deplore his loss, especially as in him there was the promise of great engineering and executive ability, accompanied by kind, considerate and pleasant manners.

OBITUARY.

Mr. John G. Graham, for twenty-three years chief sanitary inspector of Kincardineshire, passed away recently at Stonehaven, we regret to state.

LOCAL GOVERNMENT BOARD INQUIRIES.

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APPLICATIONS FOR LOANS.

Barnes U.D.C. £2,000 for electricity services.

Ebbw Vale U.D.C. £800 for a new fire station and stores.

Londonderry T.C. £10,000 for repairing roads and bridges.

Rotherham T.C. £75,000 for electrical plant.

LOAN SANCTIONED.

Ruislip-Northwood U.D.C.—£500 for surfacing and tarring.

FORTHCOMING INQUIRY.

NOVEMBER. £

1. **Wallingford.** For the extension of the sewage disposal works (Mr. P. M. Crosthwaite) ... ... —

United States Roads.—Statistics recently compiled by the Office of Public Roads and Rural Engineering of the United States Department of Agriculture show that the total length of public roads in the United States outside the limits of incorporated towns and cities was about 2,452,000 miles on January 1st last. Of this, about 277,000 miles, or 11·3 per cent. were improved with some form of surfacing. The mileage of surfaced roads has been increasing at the rate of about 16,000 miles a year.

NORWICH CITY ENGINEER'S DEPARTMENT.

REORGANISATION PROPOSALS.

A special committee appointed to consider the finances of the Norwich Corporation presented their second report recently to the city council. Since the interim report was presented the committee have directed their efforts toward a reorganisation of the city engineer's department which shall relegate to subordinates responsibility, and proportionately relieve the city engineer (Mr. A. E. Collins), and afford him greater opportunities than at present obtain of exercising supervision; and a reconstruction in his working staff, which, while maintaining the same degree of efficiency as heretofore, shall be at a lessened cost to the city. The committee suggest that divisional departments be entrusted to the care of experienced and qualified men, preferably of existing servants of the corporation who shall in effect be departmental managers. The appointments would need the support of adequate powers so that the positions occupied should be unchallenged by subordinates as regards the exercise of authority. The relegation of responsibility for departmental sections of lesser importance would be left to the city engineer to determine, and as experience might suggest as desirable.

As regards economy the subject is largely bound up with efficiency. The number of hands employed at the outbreak of war in 1914 was 559, excluding the office staff. But that number can scarcely be said to represent the maximum employed. The city engineer definitely commits himself to the statement that with a staff of 500 men as a maximum (excluding clerical assistance) he could undertake to maintain the normal work of the city at its pre-war standard. The importance of efficiency is at once apparent, for the annual saving in wages would approximate to £5,000, but on humanitarian grounds that saving can only be attained by the adoption of an adequate superannuation allowance.

It was explained by the Mayor, who moved the reception of the report, that the proposals advanced in the report were in no way intended to lessen the authority of the city engineer, but were intended "to obtain relief for our undoubtedly overworked city engineer."

The suggestion was made that the city council at the earliest opportunity should seek to obtain Parliamentary powers to create a contributory superannuation fund for the benefit of the corporation staff and permanent employees as a whole.

After discussion the report was received and referred to the General Purposes Committee to consider how far the suggestions contained in it can be dealt with at once.

HOUSING AND TOWN PLANNING.

FORTHCOMING SCOTTISH NATIONAL CONGRESS.

The Scottish National Congress to consider the preparation of housing and town planning schemes to be put in operation at the close of the war will meet at the Trades Hall, Glasgow, on Monday and Tuesday, November 27th and 28th.

The congress, which owes its inception to the Scottish representatives who accompanied the deputation to Mr. Long on September 20th, will be attended by representatives of local authorities, professional and other associations, and national associations of employers and workmen.

Resolutions will be submitted and discussions will take place upon the following subjects:

(1) The preparation of housing schemes by local authorities and other agencies, those schemes being held ready to be placed in operation at the close of the war, and the provision by the Government of the necessary capital to carry out the schemes.

(2) In view of the scarcity of housing supply the desirability of giving local authorities greater and more varied powers to stimulate and aid constructive housing action.

(3) The need for pressing forward with the preparation of town-planning schemes so as to secure right conditions for housing developments in regard to lay-out of sites, provision of amenities, and planning of arterial and other roads.

(4) The desirability in the interests of the health and happiness of the community of building self-contained dwellings with gardens instead of tenements.

Utilisation of House Refuse.

By REGINALD BROWN, M.INST.C.E., M.I.MECH.E., F.S.I., F.R.SAN.I.

The heterogeneous collection of material known as house refuse including trade refuse consisting as it does of combustible, incombustible, and vegetable matter, is looked upon as being a thing to be got rid of at the earliest possible moment for the sake of public health. It cannot be kept in the vicinity of dwellings for too long a period, constituting as it does a source of nuisance and an ideal breeding home for flies. All sanitarians have long ago come to the conclusion that the period of storage on private premises should not exceed one week; in fact, a daily collection would be the most practical ideal. Removal as "quickly as produced" is, of course, the theoretical ideal, but the engineering difficulties in the way are enormous, and are not likely to be overcome.

The cost of the service of removal and disposal of refuse from premises is enormous; taken in the aggregate in towns populous towns it is a problem to be wrestled with. One only needs to picture the immense amount of public moneys spent every year in the area known as Greater London. Its seven million people and its one and a-quarter million houses extending from Barnet on the North to Epsom on the South, Barking on the East to Uxbridge on the West, necessitates an army of horses, vehicles and men engaged in nothing else but the removal of household refuse. And when removed still another army of men is required for its disposal. In this area alone there are some one and a-half million tons collected and disposed of every year.

Now, what becomes of it all? What is the cost to the ratepayers? The methods of disposal are so well known that it seems needless to refer to them, but in view of the importance of utilising all waste matters at the present time they deserve consideration.

Examine a detailed map of the Metropolis and one finds almost every known method of disposal in existence—tips, barging, tailing, refuse destructors, and conversion into manure. One also finds that, taking Greater London as a whole, there is still a very large percentage of the refuse deposited in tips, very frequently in the area of a neighbouring authority. Each authority should deal with its own refuse within its own boundaries—so long as we are governed by boundary and not by community instead of inflicting its "nastiness" upon some other area. Tips are all very well in their way, but they are insanitary abominations, besides being absolute wasters of utilisable material. The method has nothing to commend it, unless it be so-called "economy."

WASTEFUL TIPPING.

But is it economy to tip to waste, even at little cost, material which in its utilisation would be a benefit to the individual community in particular and to the State in general? One knows that certain restrictions are placed upon local authorities in municipal trading, but a local authority has to get rid of house refuse, no matter at what cost, and it is to be hoped that the war will at least give rise to wider powers being granted to local authorities in the matter of trying to recover the cost of some of their undertakings by a judicious utilisation of the waste matters removed by them. The disposal of refuse alone costs the ratepayers of London nearly half a million pounds per annum. Tips, then, have come into being not because a "tip" is the best method, but, partly at least, because anything more demands an expenditure of capital moneys on which there can be no return—unless utilisation comes into play.

The opposite extreme to a tip is the erection of a dust destructor. Here we have the principle of dealing with the refuse in a satisfactory sanitary manner by a local authority within its own borders, and if the method were as economical financially as it is in "disposal efficiency," we should find a very much larger number of authorities adopting the destructor. Half the refuse of Greater London is still disposed of otherwise than by destructor, and it is difficult to persuade local authorities to launch out into large sums of money for the purpose of providing these adjuncts. Any hope of return, and the cost of the structure and the working expenses makes the cost of destruction per ton fairly high anything between 3s. 6d. and 5s. per ton.

That there is some heating value in the refuse is well known. There are numerous cases which prove this; in fact, it has always been considered a great waste for the heat derived from the combustion of refuse not to be utilised. The difficulty of obtaining the full heating value of house refuse is due to several causes, among which may be mentioned the following: (1) The material has to be got rid of as soon as it arrives at the works to prevent a nuisance arising from it; (2) the refuse is in its worst form for burning, being of large bulk in comparison with its weight; (3) it lies in thick, loose layers on the fire-grates; (4) it requires an excess of air for its combustion; and (5) it contains a large percentage of moisture. Tins and such like must of necessity be sorted out, whether destruction is by fire or any other method, and the clinker from the destructors has to be removed. In some districts this latter item is a serious one, but it ought not to be so, as the material can be used for a variety of purposes. Probably one of the best means of utilising it is in the surfacing of roads, as so ably shown by Mr. E. J. Lovegrove, M.INST.C.E., the borough engineer of Hornsey; and if we are to exercise economy, here is one method to which municipal engineers should give their careful attention.

CALORIFIC VALUE OF REFUSE.

It is, however, the calorific value of the refuse to which particular attention should be drawn, and this is important, especially in these days of high prices for fuel. If refuse could be conserved and utilised as and when required for steam raising or heating purposes, and if this can be done to satisfy sanitarians both in the conservation and storage, we shall, I think, have made some advance towards a solution of the problem.

FUEL FROM REFUSE.

A considerable amount of thought has been given by the writer to attain the object of "economical utilisation with sanitary efficiency." The result has been that he has devised a simple process by which this object is reached, and as it has such a far-reaching effect he has taken the necessary steps to protect his rights in the process. Briefly speaking, the process is one of crushing, pressing and impregnating. The crushing reduces the refuse to a powder, the presses convert the powder into briquettes, and the impregnating not only binds the material so as to facilitate handling, but also increases the calorific value of the fuel, and, what is more important, destroys all organic matter. There is therefore no fear of any nuisance arising from the process, no matter where it is carried on. The refuse is dealt with as soon as it is received at the works, and converted from a condition in which a very short storage would lead to offensiveness into a condition in which it can be stored for any length of time and used as a fuel as and when and where required.

Local authorities have here a method both of economical disposal and sanitary efficiency—economical because the refuse can be dealt with at a cost below the worth of the finished article, and sanitary because the method is "nuisance free." The design and lay-out of the necessary plant will, of course, depend upon local conditions and the nature and quantity of the refuse, as will also the detailed treatment to produce good results, so that it is inadvisable to give any detail plans of the process, as no one particular "lay-out" is suitable for all cases.

What we ought to be out for is "utilisation," and not "destruction."

An educational exhibit of the process was arranged at the National Economy Exhibition, People's Palace, Mile End-road, E., recently, and will, it is hoped, be again on view at similar exhibitions to be held at Manchester and Liverpool, and probably at other centres. It would not be proper at the present juncture to give the names of Government Departments, local authorities and others who are investigating the process, but it is only fair to say that since the public announcement was first made the author has been inundated with correspondence from all parts and all parties—from the widow who is looking forward this winter to being able to obtain

"a cheap fire," to the authority dealing with 100,000 tons of refuse per annum.

CHEAP HEAT.

The solution of the problem of "cheap heat" has also another important bearing on the ramifications of local government—viz., on the disposal of sludge at sewage works. It is a well-known fact that if it were possible to convert sewage sludge into a convenient form for utilisation as manure, there would be a good opening for development in this direction. Investigators into the question have all been regretting the want of a source of a cheap heat, and yet such a source has been at hand all the time only waiting to be tapped. There seems to be no reason whatever why the heating value of refuse should not be conserved, if only for this purpose. Refuse disposal works, as a rule, are in the vicinity of the population; sewage works, on the other hand, are, as a rule, at some remote distance. Without some such process as here outlined the local authority is not only wasting good material, which can, and ought to be, conserved and converted into fuel, but is also losing a source of income which might arise from the conversion of sewage sludge into a fertiliser. Whichever point of view is taken, the matter is worth investigation by all local authorities, factory owners, large manufacturers, public institutions, public service contractors, and private persons; in fact, the whole subject is one of household, municipal, and State economy.

PART-TIME SUBSTITUTES FOR FIREMEN.

(Communicated.)

Where retained or volunteer fire brigades complain that they cannot find part-time volunteers to act as substitutes for firemen who have been called up for military service, the matter should be brought to the notice of the tribunals, who, when granting exemption to tradesmen, artisans and others in certified civil occupations, or exempted for national or private reasons, can make it a condition that they join the local fire brigade for part-time service.

A popular condition imposed upon men so exempted is that they join the local V.T.C., but there are many cases, especially where men live near the local fire station, where the condition of fire brigade service would be appropriate, and the necessary powers were given to the tribunals under a recent circular from the Local Government Board (R. 95).

The fact that a man gives part of his leisure to a volunteer or retained fire brigade is, of course, no valid reason for obtaining exemption from military service, and, accordingly, many experienced part-time firemen have now left their brigades to join the Colours. Volunteers to fill their places are often difficult to obtain, and accordingly some pressure must necessarily be brought to bear on certain localities to get recruits to fill vacancies.

As to the amount of training required for a part-time fireman, in the ordinary country fire brigade this varies very much, according to the experience of the fire brigade officer who instructs them, but reasonable efficiency to render useful service under proper guidance is generally obtained in anything from twenty-four to thirty drills, so that a substitute of practical value can generally be obtained in about two or three months. As a matter of fact, in most country fire brigades firemen who have only been through some half-dozen drills attend local fires and gain experience while making themselves useful.

Waterproofing of Cement.—Nothing detracts from the appearance of a public building more than dampness. We hear that the front of Hastings Pier entrance has recently been cemented, and as a safeguard against future dampness the powder "Pudlo" has been adopted.

The Decimal System.—Asked in the House of Commons whether, with a view to enable our manufacturers and merchants more easily and successfully to compete with rival nations, he would introduce into Parliament at an early date legislation establishing the decimal system of coinage, weights, and measures throughout the British Isles, the Prime Minister said he could not at present hold out any prospect of early legislation in regard to the subject, but the suggestion would, of course, receive consideration.

SOME RECENT PUBLICATIONS.*

Large Electric Power Stations: Their Design and Construction. By Dr. G. Klingenberg. Price 25s. nett. London: Crosby Lockwood & Son.

This translation of Dr. Klingenberg's book was in type some months prior to the commencement of the war. The proofs have since been carefully revised by an English engineer, and the publishers have decided not to delay its issue further. In our view they have acted wisely in so doing, not only because of the intrinsic importance of the subject, but also because this book contains much new information on important problems in economy—information which it would be the height of folly to ignore simply because of its German origin. The first chapter deals with principles of construction. The comparison of coal transport as against transmission of electrical energy given in the second chapter will be of special interest to the many who are now confronted with questions of locality. The following chapter, on the other hand, illustrates the effect of the utility factor on the economy, and shows how the power-station losses may be separated in order to obtain proper balances for heat and running costs. Subsequent chapters contain two full constructional examples, together with a consideration of the fundamental data for the framing of tariffs. Looking to the future, the author forecasts that full economy in production will only be obtained by the large central station, and says that limitation of areas by municipal borough or even county boundaries must disappear. This opinion is of special interest to British engineers in view of the pre-war discussion on the gigantic scheme of the London County Council.

The Architects' and Builders' Pocket-book. By the late Frank E. Kidder, T. Nolan, editor-in-chief. 16th edition. Price 21s. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

For this, the sixteenth, edition of Kidder's pocket-book the whole has been rewritten by a staff of specialists under the editorship-in-chief of Mr. Thomas Nolan. Mr. Kidder's original arrangement has been retained, by which the subject-matter is divided into three parts, Part I. dealing with practical applications of arithmetic, geometry and trigonometry, Part II. with the materials of construction and the strength and stability of structures, and Part III. with miscellaneous useful information for architects and builders. To the second part has been added an entirely new chapter on reinforced concrete mill and factory construction, while new matter in Part III. includes (*inter alia*) articles on architectural acoustics and waterproofing for foundations. The work may confidently be recommended as a well-arranged encyclopædia of information for architects and builders.

Stream Pollution by Munition Works.—At a meeting last Friday of the West Riding Rivers Board it was reported that a number of complaints had been received of the gross pollution of streams in the Riding caused by the discharge of waste acid from works employed in the manufacture of munitions. The board were doing everything possible to prevent such pollutions, but there were many difficulties to be overcome.

Timber, Plywood and Woodwork.—We would direct the attention of our readers to the full-page advertisement of Messrs. C. Jennings & Company, of Pennywell-road, Bristol, which appeared in our issue of the 14th inst. The information given in the advertisement should be of the greatest value to all users of timber, plywood or woodwork. We understand that the firm are prepared to answer any questions relating to the materials of which particulars were supplied, or furnish prices delivered to any part of the world, either of goods mentioned in the announcement or of others not included in it. They inform us that they hold stock at their branches and warehouses at Porthcawl (South Wales), Leyland and Pembroke Dock, Leicester, Swansea, Hull, Liverpool, Manchester, Newcastle and other places, and will be pleased to receive inquiries.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

MOTOR TRACTION AT GLASGOW.

EXPERIMENTS WITH COAL GAS.

Glasgow Corporation Gas Committee are giving attention to proposals for the use of coal gas for road-traction purposes. Experiments proved that the consumption of gas on a run of fifteen minutes' duration was 40 cub. ft., equal to 160 cub. ft. per hour, the cost being under 4½d. Mr. R. Liggett, the official who made the experiments, is of opinion that gas should prove a strong competitor to petrol and electricity for short-distance runs and town work.

It is reported that the electricity department, who have had four electrically propelled delivery vans in use for some time, have added a 5-ton automatic tipping wagon, also electrically driven, for the conveyance of ashes from the generating stations to the coups. Another wagon of the same design is in course of construction for the same department, while one is also on order for the cleansing department.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President: Mr. JOHN S. BRODIE, M.INST.C.E., Borough Engineer and Surveyor, Blackpool.

WORTHING MEETING.

A meeting of the Institution of Municipal and County Engineers is to be held in the South-Eastern District at Worthing, to-morrow (Saturday).

PROGRAMME.

11.30 a.m.—Reception in the Corporation Art Gallery, Chesterfield, by the Mayor of Worthing, Alderman James White, J.P.

Mr. Frank Roberts, ASSOC.M.INST.C.E., engineer and surveyor, will submit brief notes on the public works of Worthing, with special reference to tarred clinker road-work, which will be taken as read.

Discussion to be followed by inspection of roads in the immediate neighbourhood.

12.30 p.m.—Luncheon at Connaught Rooms, near Art Gallery. (Tickets 3s. each.)

1.45 p.m.—Motor omnibus drive (by kind invitation of the Worthing Motor Services, Limited) to baths, isolation hospital, waterworks, refuse destructor, sewage works, and bus station.

4.30 p.m.—Return to Connaught Rooms, where tea will be provided (by the kind invitation of the borough engineer and surveyor and the town clerk), to be followed by music.

J. L. RIDDELS,
Hon. District Secretary.

MILDRED B. ROBINSON, B.SC.(LOND.),
Acting Secretary.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have now been arranged by the secretary, Mr. Alfred B. Pitts, as under:—

Nov. 10.—"Town Planning in Wales, with Special Reference to the Development of Hilly Sites," by T. Alwyn Lloyd (member).

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., V.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Percy S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffreys (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

TECHNICAL CLERK.—October 28th.—Harrogate Water Committee.—Mr. Arthur S. West, water engineer and manager.

ASSISTANT COLLECTOR.—October 28th.—Harrogate Water Committee.—Mr. Arthur S. West, water engineer and manager.

CLERK.—October 28th.—Harrogate Water Committee.—Water Office, 7 Haywra-crescent, Harrogate.

SURVEYOR'S TEMPORARY ASSISTANT.—October 30th.—East and West Molesey Urban District Council. £100 per annum.—Mr. J. Stevenson, surveyor, Council Offices, East Molesey, Surrey.

SURVEYOR.—October 31st.—Littlehampton Urban District Council. £220—£300 per annum.—Mr. A. Shelley, clerk, Littlehampton.

RESIDENT ELECTRICAL ENGINEER.—October 31st.—Atherton Urban District Council. £200 a year.—Mr. William Garnett, clerk, Town Hall, Atherton.

RESIDENT ELECTRICAL ENGINEER.—October 31st.—Horsham Urban District Council. £220 per annum. Mr. S. Mitchell, clerk, Council Offices, Horsham.

SURVEYOR.—November 1st. For the Justices of the Blackheath Division.—Clerk to the Justices, London County and Westminster Bank Chambers, 2 Church-street, Greenwich, S.E.

SURVEYOR, COLLECTOR, AND INSPECTOR OF NUISANCES.—November 2nd.—Hay Urban District Council. £200 per annum.—Mr. Robert T. Griffiths, clerk, Hay, *vid* Hereford.

PLUMBER AND WATER-WASTE INSPECTOR.—November 4th.—St. Ives Town Council, Cornwall.—Mr. S. Palmer, borough surveyor, Council Offices.

BOOK-KEEPER AND CLERK.—November 8th.—Godalming Town Council. £2 2s. per week.—Mr. Alan Bromly, borough surveyor and water engineer, Municipal Offices, Godalming.

SURVEYOR OF SEWERS.—November 11th. Commissioners of Sewers for the County of Lincoln. £250 per annum.—Mr. G. Beaumont Walker, clerk of sewers, Clerk's Office, Spilsby.

TEMPORARY ASSISTANT SURVEYOR.—Whiston (Lancs) Rural District Council.—Mr. R. J. Knapman, surveyor and sanitary engineer, Council Offices, Whiston, Prescot, Lancs.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

SHEFFIELD.—November 7th.—For the erection of a fitter's shop, for the Electric Supply Committee.—The Offices, Commercial-street, Sheffield.

Engineering: Iron and Steel.

RUNCORN.—October 28th.—For the supply of vertically cast cast-iron spigot and socket water pipes, coated with Dr. Angus Smith's solution inside and out; also 6-in. sluice valves, 2½-in. hydrants, hydrant casings, and valve casings, for the urban district council.—Mr. James Wilding, surveyor and water engineer, Town Hall, Runcorn.

MANCHESTER.—October 30th.—For the supply of about 308 tons of cast-iron hydraulic (high-pressure) pipes, and about 17 tons of specials, for the corporation.—Secretary, Waterworks Offices, Town Hall, Manchester.

BOLLINGTON.—October 31st.—For putting down a borehole, for the urban district council.—Mr. S. Knight, clerk, Council Offices, Bollington, near Macclesfield.

NEW ROMNEY.—November 1st.—For the supply of posts and wire fencing, for the corporation.—Mr. W. Lamacraft, town clerk, New Romney, Kent.

DORSET.—November 6th.—For repairing and widening the Creekmore Bridge, for the county council.—County Offices, Dorchester.

BRAY.—November 7th.—For a second-hand travelling steam crane, 4 tons, for the urban district council.—Town Clerk, Town Hall, Bray, co. Wicklow.

WALLASEY.—November 21st.—For the supply and erection of 25 per cent liquor concentrating plant and connections at the gasworks, for the corporation.—The Gas Engineer, Limekiln-lane, Seacombe, Wallasey.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

Roads.

WANGFORD.—October 30th.—For the supply of granite, gravel or marl, and carting, for the rural district council.—Mr. E. W. Debenham, clerk, Shipmeadow.

BRAINTREE.—October 30th.—For steam rolling and scarifying, and the supply of broken granite, for the rural district council.—Mr. C. Vernon Bright, surveyor, London-road, Braintree, Essex.

NORFOLK.—November 1st.—For the supply of granite for a year, for the county council.—Mr. W. W. Gladwell, county surveyor, The Shirehouse, Norwich.

WIGAN.—November 1st.—For the supply of 300 tons of granite setts, for the Tramways Committee.—Mr. A. T. Gooseman, borough engineer, Wigan.

MADRID.—November 7th.—For the construction and maintenance of granite pavements.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Miscellaneous.

WARRINGTON.—October 30th.—For the supply of second-hand S.H. bags, for the Sanitary Works Committee.—The Manager, Longford Depot, Warrington.

RHONDDA.—October 30th.—For the supply of stoneware pipes, bass brooms, rotary brushes, picks, shovels, road scrapers, tools, iron castings, street gratings, manhole covers, paving, kerb, channel, pitching, Portland cement, macadam, granite road macadam, limestone macadam, and tarred macadam, for the urban district council.—Mr. E. H. Barber, engineer and surveyor, Council Offices, Pentre, Rhondda, Wales.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

OCTOBER.

28.—Institution of Municipal and County Engineers. Meeting at Worthing.

NOVEMBER.

6. Society of Engineers: Mr. C. T. A. Hanssen, Assoc.M. Inst.C.E., on "Heating and Ventilating Private Dwelling Houses." Caxton Hall, Westminster, 5.30 p.m.

10.—Town Planning Institute: Mr. T. Alwyn Lloyd on "Town Planning in Wales, with Special Reference in Development of Hilly Sites."

13.—Surveyors' Institution: President's opening address. 5 p.m.

DECEMBER.

8.—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

BOROUGH OF ST. IVES, CORNWALL.

Wanted, a Plumber and Water-waste Inspector (during the absence of present inspector on active service).

Applications, stating age, experience, and salary required, accompanied by copies of three recent testimonials, to be sent to the Town Clerk, endorsed "Water-waste Inspector," by November 4th, 1916.

S. PALMER,
Borough Surveyor.

Council Offices,
St. Ives,
Cornwall. (3,139)

BOROUGH OF GODALMING.
BOOKKEEPER AND CLERK.

The Council require the services of a competent Bookkeeper and Clerk in the Surveyor's Department, at a commencing salary of £2 2s. per week.

Male applicants must be ineligible for military service. Some previous municipal experience is considered desirable.

Written applications, stating age and qualifications, should reach the undersigned not later than Wednesday, 8th November, 1916, accompanied by copies of three recent testimonials.

ALAN BROMLY,
Borough Surveyor and Water Engineer.

Municipal Offices,
Godalming.
October 18, 1916. (3,136)

SURVEYOR OF SEWERS WANTED.
WAPENTAKES OF CALCEWORTH, CANDLESHOE AND HILL, AND SOKE OF BOLINGBROKE, AND PART OF THE WAPENTAKE OF LOUTH ESKE.

His Majesty's Commissioners of Sewers for the County of Lincoln require the services of a General Surveyor of the Sea Banks, Gowts, Culverts, Rivers, Banks, Drains, and other Works and Defences of Sewers within the said Wapentakes and Soke.

The Surveyor will be required to reside within the district, and to devote the whole of his time to the duties of the office.

The salary will be £250 per annum.

The general duties may be ascertained on application to the undersigned.

Applications, with testimonials, must be delivered at my Office in Spilsby on or before the 11th November next, endorsed "Surveyor of Sewers."

(By order)
G. BEAUMONT WALKER,
Clerk of Sewers.

Clerk of Sewers' Office,
Spilsby.
October 24, 1916. (3,140)

HAY URBAN DISTRICT COUNCIL.
APPOINTMENT OF SURVEYOR, COLLECTOR AND INSPECTOR OF NUISANCES.

The Council invite applications from persons ineligible for military service for the above combined Offices, at a salary of £100 per annum, being £50 as Surveyor and Collector and £50 as Inspector of Nuisances.

The person appointed must hold the Certificate of the Royal Sanitary Institute or some other examining body.

The combined appointments will be determinable by three months' notice on either side. The duties of the Inspector of Nuisances will include those of inspection and keeping records under the Housing (Inspection of District) Regulations, 1910. Office accommodation will be provided.

The person appointed will be required to devote the whole of his time to the duties of the appointment, and to give approved security for £400.

Canvassing, either directly or indirectly, will disqualify.

Applications, in candidate's own handwriting, stating age, qualification and experience, and accompanied by copies of not more than three recent testimonials, and endorsed "Surveyor," are to be sent to me not later than Thursday, November 2nd next.

The appointment will be made subject to the selected applicant being approved by the Local Government Board for the office of Inspector of Nuisances.

ROBERT T. GRIFFITHS,
Clerk to the Council.

Hay, *via* Hereford.
October 17, 1916. (3,141)

The Surveyor

And Municipal and County Engineer.

Vol. L. NOVEMBER 3, 1916. No. 1,294.

Minutes of Proceedings.

United States Roads.

During the past twelve years the annual expenditures on the rural roads and bridges in the United States have increased from about £16,000,000 to about £56,100,000, or an increase of more than 250 per cent. During this same period the annual expenditures from State funds for road and bridge construction and maintenance have increased from £510,000 to £10,698,400, or almost 2,000 per cent. In 1904, out of the total road and bridge expenditures, £4,000,000 of the £16,000,000 was paid in labour, that is, worked out on the roads. The actual cash road and bridge expenditures at that time amounted to only £19,990,600, of which £796,000 was secured from local bond issues and £3,000,000 from State funds. Supervision and control of road and bridge work by State highway departments existed in only eleven States, and amounted only to about £900,000. Less than 6 per cent of the total road and bridge expenditures during 1904, therefore, were under even patent State supervision. During 1915 the total road and bridge expenditures in the United States amounted to about £56,100,000, of which probably not over £3,000,000 represented the value of the statute and convict labour performed on the roads. Of the cash expenditures of £53,395,279, about £8,000,000 was secured from local bond issues and £10,698,330 from State funds. In addition to the £10,698,330 of State funds, £5,404,699 of local funds, or a total of £16,102,939, was expended under the supervision of the State highway departments in the construction of 12,137 miles and the maintenance of 51,769 miles of public roads. This is slightly more than 30 per cent of the total cash road expenditure, or more than 11 per cent of total road and bridge expenditure in 1904. In 1904 the actual cash road and bridge expenditure in the United States averaged slightly less than £5 16s. 6d. per mile of rural roads, but in 1915 it had increased to an average of £22 13s. 6d. per mile of road.

The public roads of the United States outside the limits of incorporated towns and cities have at the present time a total length of about 2,452,000 miles, of which about 277,000 miles, or 11·3 per cent, are improved with some form of surfacing. The mileage of surfaced roads is increasing at the rate of about 16,000 miles per annum. During 1915 those States having State highway departments surfaced under such supervision about 8,000 miles, and also improved by grading and otherwise an additional 4,000 miles. Thus of the really constructive road work in the United States last year about one-half was more or less directly under competent State supervision. In addition to this work of construction the several State highway departments also supervised the maintenance of 51,769 miles of main and trunk line roads. The remarkably rapid increase in United States road expenditures during the past twelve years, however, is not all due to increased activity in construction. A large portion must be charged to the demand for better and consequently more expensive types of construction, as well as greatly increased maintenance costs made necessary by the changed traffic conditions. The effect of the motor vehicle on the cost of road construction and maintenance had not become apparent in 1904. To-day many of the roads carry a motor traffic far in excess of the total traffic of all classes carried twelve years ago. At the present time there are about 2,500,000 motor vehicles in use on the public roads, or about one motor vehicle for every mile of road. This motor traffic is not uniformly distributed, but largely concentrated on certain roads. This is the underlying reason why maintenance and reconstruction costs have increased so rapidly on many of the roads, and why the total road expenditures have increased so much more rapidly than the mileage of improved roads.

One of the most striking developments in regard to the management of United States highways during recent years has been the ever-increasing participation of the State governments. The first State aid law was passed by New Jersey in 1891. On June 1, 1916, all but four States—Georgia, Indiana, South Carolina, and Texas—had some form of State engineering or State highway department. Through these State highway departments the several States had expended to January 1, 1916, a grand total of £53,070,165 State funds for road construction, maintenance, and the administration of the departments. A total of 50,402 miles of roads have been constructed under State supervision, of which about 40,000 miles are surfaced, to the cost of which both State and local funds have contributed. The several States have also supervised and contributed largely to the maintenance of systems of State and State-aid roads which last year amounted to 51,769 miles. The largest expenditure of State funds has been by New York State, which, from 1898 to January 1, 1916, reached the imposing total of £19,324,499.

* * *

Chlorine Gas.

One of the results of the great war is the total upsetting of all calculations of the cost of water sterilisation by means of choride of lime. Owing to the great increase in the price of this material the treatment of water in large quantities with, say, 2 parts per 1,000,000 of available chlorine, which means more than 6 parts per 1,000,000 of chloride of lime, has become a serious item of expense. Thus chlorine gas, which had already been largely used as a sterilising agent, received more favourable consideration than would otherwise have been the case, and this is exemplified by the fact that the water supply of Greater New York is now being treated with liquid chlorine. Here there is a daily output of 1½ tons of chlorine, with which 400,000,000 gallons of water are treated per day. This is the largest plant of its kind in the world, and will probably

settle for a long time to come the respective claims of the two methods—namely, sterilisation by means of chemical hypochlorite and sterilisation by means of chlorine gas. It is also noteworthy that a plant for making chlorine gas from brine is being built by the Montreal Water and Power Company. The gas will be made in sufficient quantities to treat 30,000,000 gallons of water per day. As everyone knows, chlorine is easily made, and it is clear that where a water company can make its own sterilising agent, and when this agent is in the form of a gas, there should be a great saving in the cost of chemicals and in the cost of handling. The reason of the success of the chloride of lime treatment was its simplicity, or perhaps it would be wiser to say its apparent simplicity, for there are many pitfalls. The same may be said in a greater degree of the chlorine-gas treatment. Having said this, it does not follow that either is really the cheapest or most economical method. With regard to chlorine gas, it is to be remembered that when a water authority prepares it in large quantities it is dealing with something extremely dangerous. This is the gas which is being used by the Germans for other purposes than water sterilisation, and the possibility of evil consequences should not be overlooked. There is something unpleasant in the fact that the sudden adoption of chlorine gas and of plant for making it in enormous quantities should coincide with the large demand for the same material in the war.

Some of the greatest authorities have held, and we believe still hold, the view that the treatment of water by means of electrolytic hypochlorite is not only more economical, but possesses many advantages over the other two methods. Apparently we have here an instance where the teachings of science are disregarded entirely by the capitalist and by the manufacturer, and it is probable that there is still a fortune awaiting the person who has the courage and ability to take the matter up and not only prove the value of the process, but place on the market apparatus capable of doing what scientists have shown to be possible. If what the chemists tell us is right, New York might certainly have saved the cost of its chlorine gas by making use of electrolised sea-water, and the same might be done at any other place by the sea. It is too much to believe in the face of the proofs given that there is any mistake as to this possibility. There can only be one reason why the process has not been adopted, and this is that it has not been pushed in a commercial sense. We have plenty of instances of valuable inventions unheeded for many years until some person of unusual wisdom or luck thought it worth while to force it forward by means of advertisement and ordinary trade methods. It is, however, strange that in an age which is supposed to be scientific we pay more attention to the teachings of the tradesman than to those of the scientist. Economy, of which we now hear so much, is not to be obtained in this way. Everyone agrees that it will pay the manufacturer to consult the scientist to a greater degree, and it will certainly pay public bodies to rely more upon the skill of the best scientific advisers and less upon the advice of trading firms.

* * *

War and Health.

As is usual, one of the principal features of the recent annual conference of the Sanitary Inspectors' Association was an admirable presidential address by Sir James Crichton-Browne. In paying a tribute to the public health administration of Cardiff, in which city the conference was held, Sir James pointed out in characteristic language that "it maintains a public health laboratory, or intelligence department, where the movements of the microbes are observed and reported, an isolation hospital where they are interned when caught, an air service where meteorological observations are made, and it has entrenched itself in a system of well-constructed drains." Probably the most interesting part of the address, however, was that which dealt with the medical and surgical miracles of the war. In all previous wars, ten men have died or been disabled by disease for every one killed or wounded, but in the present war, for the first time in our history, the proportion has been reversed. But, unfortunately, experience shows that the direct connection between war and disease is not confined to the actual period of hostilities. We were not prepared for war, declared Sir James, but let us be prepared for peace. Indeed, the period immediately following the conclusion of hostilities will probably be one of abnormal activity for the whole service of public health administration.

In Sir James Crichton-Browne's view, among the social and domestic reconstruction that is to follow the war the most vital part will be housing reform. "We cannot send back the brave men who have fought for us abroad into hovels and dug-outs and funk-holes at home—yes! veritable funk-holes, for not without fear and trembling would anyone who knows what health means enter many of the dwellings in town and country that are still the only available shelter for some of our poorer classes. We must not any longer leave multitudes of our people huddled together in habitations that are incubators of disease and debasers of morality." The remedies for slumdom suggested by Sir James are a living wage and extensive building operations under the direction, and if need be with the assistance, of the State. Dilatory tactics and mere makeshifts will no longer be tolerated. Radical measures will be adopted. If local authorities are still reluctant to exercise the powers entrusted to them under the Housing Act, then they must be expedited in their movements by the Local Government Board, upon which compulsory powers should be conferred, such assistance as may be needful to carry out approved schemes meeting modern requirements of housing being provided by contributions from the National Exchequer. All of which agrees with what we have been saying for many months past.

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Sanitation and Mathematics.

Although the connection between sanitation and the higher mathematics may not be evident at first sight, such a connection does exist, as is shown by a perusal of the paper on "The Element of Chance in Sanitation," which was read lately by Mr. G. C. Whipple before the Mechanical and Engineering Section of the Franklin Institute. The point is that the frequency with which given events will happen is subject to mathematical analysis according to the theories of probability—often spoken of as the laws of chance. The application of these laws is often recognised in engineering work without direct knowledge on the part of the engineer. Thus, to take the first example that occurs, whenever a factor of safety is allowed, the law of chance is unconsciously applied to guard against unsuspected loading or undiscovered weakness of material. Sanitary engineering in the modern sense, dealing as it does not only with matters of pure construction, but also with problems of chemistry and biology, affords a wide field for the application of the laws of frequency and variation. For instance, it has been established that if, in a series of daily observations of the number of bacteria in a filter extending over a year the deviation of any determination from the mean should be found to be more than five times as much as the probable error, this should be rejected from the series as being, for some reason or other, abnormal. Obviously the application of this rule, which cannot be used without a prior determina-

tion of the "probable error," makes for greater accuracy in the records of such observations. Again, in studies of vital statistics the attempt is often made to compare death-rates for different years or in different places in the effort to trace the effect of some supposed cause such, for example, as an improvement in the public water supply or the introduction of a sewerage system. In making these studies it is necessary to take into account the fluctuations in the death-rates which are due to other causes than the one under investigation. Here once more the laws of probability will prove useful. There is no need to say more here except to advise those of our readers who may be interested to study Mr. Whipple's paper, which is published in the Journal of the Franklin Institute. Enough has been said to show that this important branch of mathematics can be profitably applied by engineers and health officers as well as by biologists.

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The London Arterial Roads Scheme.

The scheme of arterial roads for London, which was the result of a series of conferences held from time to time, was the subject of a deputation to Mr. Walter Long on Tuesday last, and though it would not be correct to say that the matter has received its *quietus* from the President of the Local Government Board, there is no doubt that for a considerable time to come it will perforce remain in a very pronounced state of suspended animation. The necessity for the scheme is obvious to all who are interested in the problem of London's multitudinous traffic, and the transition from horse vehicles to mechanically propelled traction has made the necessity urgent if the growing requirements of the Metropolis are to be recognised and met. It was quite a laudable spirit, therefore, on the part of the public authorities of London that were responsible for the movement, and though there were many difficulties to be overcome, alike from the practical and financial standpoints, there was a probability that the scheme would eventually be initiated under departmental sanction. The intervention of the war, though embarrassing, was not regarded as fatal to the project, and a hope was cherished that the necessary work entailed would come in opportunely for large numbers of men from the demobilised Army after peace had been proclaimed. All these aspirations and anticipations, not over-ambitious if the circumstances of the case are duly appreciated, are doomed to disappointment, for the only comfort Mr. Long could give the deputation was to tell them that he would ask Sir George Gibb, on behalf of the Road Board, to examine the scheme and report as to the relative importance of the proposed roads. He added definitely that if he were Minister at the end of the war it would be his duty to advise the Government that the first call on public funds ought to be for the housing of the people, for sanitation, and for water supply, without which housing was of little value. These are admittedly objects of high national importance, and no complaint can be reasonably made that they should take precedence over the proposal for arterial roads. Nevertheless it is permissible to regret that a scheme charged with so many possibilities for the improvement of London and Greater London should be relegated to the obscurity and doubt of a future existence.

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The Worthing Meeting.

Last Saturday's meeting of the Institution of Municipal and County Engineers at Worthing was a highly successful gathering, in spite of adverse weather conditions. The members were officially received by the mayor, who, in the course of his speech of welcome, paid a warm and well-deserved tribute to the work of the borough engineer, Mr. Frank Roberts. A brisk discussion followed the reading by that gentleman of a paper on "The Public Works of Worthing," which was of considerable merit, and from the speeches that were delivered it was evident that the interest of the members was aroused chiefly by the use of tarred clinker for road making, and the works of sea defence. The use of tarred clinker was at first rather in the nature of an experiment, but it has been thoroughly justified by the result. Mr. Prescott, of Eastbourne, was only voicing the general opinion when he said that the roads laid during the past two or three years were very excellent indeed, and that the motor-omnibus traffic which they carried was a convincing proof of their efficacy. In considering the question of sea defence it must be remembered that Worthing has a sea frontage of over 3 miles. This has been protected by the erection of timber groynes, which have successfully withstood the inroads of the sea, rendering the construction of an expensive sea wall unnecessary. Many of these groynes have been erected by Mr. Roberts, and the improved conditions that have obtained in recent years testify to his skill.

The "C.O."

The lot of the conscientious objector, like that of Gilbert's policeman, is not a happy one. A new illustration of this is afforded by the proceedings at a recent meeting of the Risca, Monmouthshire, Urban District Council, when a discussion arose on the employment by the surveyor of one of these individuals on the council's work. The surveyor took the line that he had never yet stopped to inquire into the opinions of any applicant for employment, and that, following the usual practice, he had not done so in the case in question. The man was out of work, and the surveyor was in want of a man, so he employed him. As a general principle there can be no doubt that this is the only safe attitude for a public official to adopt. It is not surprising, however, that in this instance public opinion in the district should have manifested itself, and perhaps the surveyor would have acted more discreetly if he had consulted his committee. Be this as it may, he certainly adopted the right attitude when the question was raised subsequently in making the council assume the responsibility for the man's dismissal, and we cannot agree with the chairman of the meeting, who said that in his opinion the surveyor had put up "an extraordinary defence." If the surveyor is expected to discriminate against the conscientious objector, whose position is recognised (if not created) by Act of Parliament, why not against the atheist or socialist?

The Institution's Orphan Fund.

In his courteous acknowledgment of our usual donation to the institution's Orphan Fund, Mr. O. Claude Robson, its hon. secretary and hon. treasurer, notes that he finds some difficulty in securing subscriptions at the present time, but is in hopes that the usual annual amount may be received, notwithstanding the hardships encountered in so many directions. Municipal engineers we are sure will strive their hardest to ensure that his hopes are realised. The "O," which is the initial letter of Mr. Robson's first name, might well stand for "Optimist," as neither rebuff nor discouragement has ever been able to divert him from his cheery, tactful and indefatigable efforts to make more powerful for good the cause he has so much at heart. On personal grounds, as well as in view of the appealing nature of the fund's object, we beg municipal engineers in this time of crisis to support it generously, even though the effort mean a further strain upon the self-denial which undoubtedly so many of them are already exercising.

Disposal of Sewage Sludge by Aëration.

By GEORGE T. HAMMOND, Bureau of Sewers, Brooklyn.

[The treatment of sludge by "activation," as is done with sewage, is the suggestion of Mr. Hammond in a paper presented before the Water, Sewage and Sanitation Section of the recent Annual Congress of the American Chemical Society and summarised in "Engineering Record." The amount of sludge which must be disposed of, Mr. Hammond pointed out, easily stands first among the problems of the activated-sludge process of sewage treatment. This amount varies from 2,000 to 4,000 gallons, or more, per million gallons of sewage, and the material has a water content of from 99 to 96 per cent. To minimise this surplus sludge Mr. Hammond sees possibilities in the use of fine screens and in some scheme of prolonged aeration.

Sludge from the activated method of sewage treatment is highly putrescible unless dewatered, which is an expensive operation. Success in dealing with this problem is reported by Mr. T. Chalkley Hatton, of Milwaukee, but the details and cost data are not yet available. At the Armour & Company plant at the Chicago stockyards experiments are still under way with dewatering methods, but their conclusions are reported as not final. It seems to them, however, that a battery of vertical-flow settling tanks, which decrease moisture to 97 per cent, followed by a Worthington or similar press, is the best method up to the present. The sludge, after pressing, is dried by a direct or an indirect heat drier to 10 per cent moisture, which is necessary in order that the material may be used in making fertiliser. The cost of this method, according to Mr. Hammond, is such that the commercial value of the product must be considerable in order to make the treatment available. It means of transporting the dried product to market are costly, or fail at a critical moment, serious trouble may arise.

"Our further analyses of the sludge for fertiliser value," writes Mr. Noble, of Armour & Company, "show it will run between 4½ and 5 units of ammonia, the value of it being therefore about what we have previously estimated—$9 to $10 per ton in the dried state." These figures, Mr. Hammond explained, refer to the sludge derived from the stockyard sewage, and will probably not be equalled with ordinary domestic sewage.

REMOVAL OF SUSPENDED MATTER.

It is quite probable, Mr. Hammond believes, that this difficulty can be overcome to a considerable extent by means directed to the removal of sludge-producing material from sewage previous to the treatment—for instance, by screens or tanks. So far no complete data are obtainable on this point, but experiments seem to justify the expectation of success. Experiments are needed to show how fine such a screen should be, for if it removes too much suspended matter the process may be seriously interfered with. So far as Mr. Hammond's experience goes the Imhoff tank is not likely to prove as successful as the screen in this preliminary treatment, as the tank takes out too much of the best size material in suspension for the activation process; but this is not stated as having been proved conclusively. If an Imhoff tank is used, the surplus activated sludge might be reduced to the condition of Imhoff sludge by being introduced into the digestion chamber, as suggested by Mr. Leslie C. Frank.

While the conditions at Milwaukee are rather unique, and favourable to the activated sludge method, as well as to the transportation of the dewatered sludge, it is doubtful, in Mr. Hammond's opinion, if other cities less favourably situated will feel justified in going to the expense of installing extensive plants for dewatering sludge. The combination of a commercial venture with sewage disposal need not necessarily prove a failure, but the chances against its success do not make the project seem attractive.

REDUCTION OF MOISTURE.

A recent communication from Mr. Hatton states: "After elaborate experiments on the dewatering of sludge and sludge drying, we find that there is little of the problem connected therewith that has not already been solved in industrial establishments where material of like character must be treated. Either of two kinds of process will reduce the moisture from 99 to 75 per cent, and there is no difficulty by either the direct or indirect drier to reduce this moisture from 75 to 10 per cent or lower."

This statement is of great interest, and seems very promising. It seems to Mr. Hammond, however, that in most places the problem will always be how to minimise the formation of surplus sludge, and how to get rid of what does form without dewatering it in a plant especially provided for this purpose. If it costs more per ton to dewater than the sludge will sell for, or the nett value obtainable therefor, then, even though the value figures at $9 to $10 per ton, few will care to undertake such a venture, or at least go farther than what would be the fair cost of sludge disposal by other means.

Dewatering sludge is a matter of difficulty and expense, and cannot but add a burden to the maintenance of a plant. This may be provided for in large plants, if the value of the sludge recovered warrants, but in small plants it would probably lead to a nuisance, and would not be usually undertaken where the sewage amounts to less than 10,000,000 gallons per day.

SLUDGE DRYING PROGRESS.

The Schaefer-ter-Meer centrifugal sludge drier, used on a large scale at Frankfort-on-the-Main, and at Hanover, in Germany, has been thoroughly developed as a sludge-drying machine, which can handle with success large volumes of sludge and dry it sufficiently to burn readily in an incinerator plant. This machine was experimented with at the Jamaica sewage disposal plant on Long Island, N.Y., and tests show that operating on sludge containing 91·5 per cent of moisture, from a lime-precipitation tank, it effected a removal to 64·2 per cent moisture, and operated continuously while effecting this removal. The cost of this method, as shown by the tests, was rather high, but the tests were really not a fair exhibition of what these machines can do, as the sludge treated was limed sludge and entered the machine in a sticky state, not favourable for economical operation.

The Dickson method of sludge dewatering, which employs brewers' yeast to effect a separation of water and sludge, also offers a possible means of success, and has the advantage of a fully developed system by means of which the dewatering and drying can be carried from the commencement to the completion of the process, without extra handling between the various steps. The dried sludge leaves the apparatus in bags ready for shipment to the fertiliser factory, or may even be made a complete fertiliser ready for market as it leaves the plant.

So far the cost of these methods has not been determined for activated sludge, but Mr. Hammond believes it will be lower than the cost for drying ordinary sludge. It is quite possible that the sludge may be destroyed by a septic process where the amount of it is not great enough to make dewatering an attractive measure. But little study has been done in this direction, and much is desirable.

SUGGESTS SLUDGE AËRATION.

As the sludge tends to break up and dissolve with over-aëration, and in doing so diminishes in volume, this gives promise of still another method that so far has received but little study. It has been found that by means of long-continued aëration activated sludge may be broken up and reduced to 10 per cent or less of its original volume. The problem is to get rid of the water during this reduction, so as to decrease the volume to be aërated. That this may be done seems fairly possible.

"Taking the surplus activated sludge as a special problem, it would seem," states Mr. Hammond, "that we should be able to design a plant to reduce its putrescible contents by means of biological agencies. If we may treat the sewage by 'activation,' why may we not also find such a means of treating the sludge? Since we have found that long-continued aëration will reduce it to a very small volume, can we not find means of doing this without excessive cost for air?

"We observe that after a short aeration period

with activated sludge. The separation of the sewage takes place, and that out of 1,000,000 gallons we have a definite amount of 2,000 to 4,000 gallons of sludge, which we must dispose of separately, and this is about 99 per cent water. Clearly we can afford to aerate this small volume for a long time if necessary, to effect its reduction to a form which will not cause a nuisance. Experiment shows that about half of this volume is free water which can be removed by an hour's tank-age, and that twenty-four hours' aeration of the sludge will separate a large part of its remaining water, and the bacteria will keep on working for us. Thus we are continually treating a diminishing quantity of sludge, and the problem of design seems the principal problem."

WORTHING'S TARRED CLINKER ROADS.*

By FRANK ROBERTS, ASSOC.M.INST.C.E., Borough and Water Engineer.

In 1905 the author considered the question of the utilisation of destructor clinker as apart from the usual practice of mortar making and the manufacture of paving slabs, of which he had had previous experience.

As an experiment the clinker was first broken coated with tar, and laid on the road at the corporation depot. This proving satisfactory, a trial was made with the tarred clinker as a material for the resurfacing of roads, the first carriageway being completed in August, 1905.

This road was watched carefully during the winter months, and the author decided to recommend his council to adopt the material for the resurfacing of roads generally within the borough, with the result that to-day over 13 miles of carriageways have been treated in this manner.

The clinker is carted from the refuse destructor to the corporation highways depot, where it is broken in a crusher driven by an electric motor and the smaller clinker screened and separated from the coarser material.

The larger material of about 1½ in. in diameter was formerly thoroughly mixed and incorporated as follows: ½ cub. yd. broken clinker, 6 gallons of crude tar, 1 gallon of creosote oil, and 30 lb. of pitch.

The mixing machine was supplied by Messrs. Toward & Co., Newcastle-on-Tyne.

In recent years the broken clinker has been mixed with "prepared" tar in lieu of the above mixture with equally satisfactory results.

The material after being mixed is allowed to mature for a period of two or three months, when it is turned over and freshened with a small quantity of tar before being spread on the roads.

The roads, before being resurfaced, are usually coated with water-bound flints during the autumn and winter, finished with a crossfall of about 1 in 24. The flints are allowed to consolidate, and in suitable weather the surface is brushed hard with a stiff horse-broom, the result giving a sufficient key for the tarred clinker, which is then spread to an even thickness of about 3½ in. and well steam-rolled to a finished thickness of about 1¾ in. A coating of fine tar clinker is then spread over the whole surface and finished to a good face by steam rolling, after which the roads are opened to traffic. After a period of three months, when the material becomes quite hard, the surface is tar-painted and covered with a thin coating of ⅛-in. granite chippings well rolled, which gives a pleasing colour to the surface.

Analysis of cost per square yard:—

Value of clinker at destructor	·75
Carting from destructor to depot, and on to roads	2·50
Preparation of material, including all labour, electrical energy, tar, &c. ...	3·1076
Spreading and consolidating material on roads	5·2916
Tar-painting and dusting with granite chippings	2·25
Total cost per square yard	13·8992

As the following figures will show, there has been a considerable reduction in the cost of both the watering and cleansing of streets since the council first adopted the tarred-clinker roads, notwithstanding that several new streets have been taken over by the council:

Year ending.	Street watering (excluding cost of water).	Street cleansing.
March 31, 1907	£582 ...	£1,501
March 31, 1916	£222 ...	£1,428

The author has been frequently told that the traffic in Worthing is not "heavy," but he would point out that in several streets there is a continuous service of motor omnibuses, both local and to and from Brighton, in addition to the ordinary traffic, which cannot be ignored in a town with a resident population of 33,000. The traffic is greatly increased by the large number of visitors in the summer months, and to a lesser extent during the remainder of the year.

Members may also be interested in road work carried out in South-street in 1905, which was constructed as follows:—

The upper surface of the flint road was scarified to a depth of 3 in. and the flints removed. On the old foundation a layer of natural rock asphalt, supplied by Val de Travers Asphalte Company, Limited, was spread 5 in. in thickness and afterwards steam-rolled until the whole of the material was compressed to a thickness of about 3 in., the small interstices being filled in with pieces of asphalt by hand and the surface re-rolled. The total cost was 4s. per square yard. No blinding, water, tar, or any other material was used to bind the rock asphalt, the consolidation by the steam roller being all that was required.

* From paper presented at the meeting of the Institution of Municipal and County Engineers held at Worthing on Saturday last.

THE LAY-OUT OF LIGHTING SCHEMES.*

By FREDERD. H. TAYLOR, ASSOC.M.INST.C.E., A.M.I.MECH.E.

The tendency of the present day, in arranging schemes of artificial lighting, is, as in many other matters, to endeavour to crystallise the whole matter as much as possible and in the case of lighting into three points—that is, height of lamp or lighting "unit," spacing distance, and the candle-power of the unit employed. One realises this from an inspection of the catalogues of the several enterprising firms who specialise in lighting material, and who publish so much information concerning their manufactures for the guidance of potential purchasers.

While useful enough and easy of application in *new* buildings, where the architect is willing to give consideration to the requirements of artificial lighting, in *old* buildings the points mentioned commonly have to be the subject of part consideration only, in order that other influencing conditions may have necessary consideration. Hard-and-fast rules for the lay-out of artificial lighting in an industrial type of building would therefore appear to the author as undesirable, even if possible of general application. It is true that progress is being made in the direction of deciding as to what is a suitable standard or intensity of illumination for various processes and kinds of work, but this is, and will probably remain, as the *minimum* illumination necessary, rather than the average. Lay-out must therefore be settled not on this point only, but on due consideration of the many other variable points which will be found to enter into almost every case one meets in practice.

A point one would specially draw attention to in this connection is the need of "general" as well as "local" or "individual" lighting in most, if not all, of the premises which the mechanical and the civil engineer have to deal with. Individual or local lighting of sufficient intensity for machine tools, benches, desks, &c., is necessary if each operator is properly to perform his duties. "General" lighting, on the other hand, is equally necessary, for by this proper supervision and discipline is possible and the safety of those persons secured who have to move about through passages and gangways. This need of "general" lighting is, even at the present time, often entirely overlooked.

Institution of Sanitary Engineers.—At a meeting of this body to be held at Caxton Hall, Westminster, on Thursday, November 9th, Sir John McCall, Agent-General for Tasmania, will give an address on "The War for Health." The president, Mr. A. P. I. Cotterell, will take the chair at 5.30 p.m.

* From a paper read before the Junior Institution of Engineers.

Brief Notes on the Public Works of Worthing.*

By FRANK ROBERTS, Assoc.M.Inst.C.E., Borough and Water Engineer.

Worthing, although not the county town, is the largest of all the towns in the county of West Sussex, and is one of Nature's most favoured spots, being delightfully situated at the foot of the South Downs on the South Coast midway between Beachy Head on the east and Selsey Bill on the west. Towards the end of the eighteenth century Worthing was a small fishing hamlet adjacent to the village of Broadwater to the north, and is now a popular health resort with a resident population of over 33,000.

STATISTICS.

Area.—3,012 acres, including foreshore.

Rateable value, £208,527; assessable value, £191,638; general district rate, 3s. 2d. in the £; poor rate, 3s. 6d. in the £.

Loans outstanding at this date.—Water, £33,023;

Mr. Frank Roberts, Assoc.M.Inst.C.E.

[Mr. Roberts has held his present appointment since 1896. After serving his articles with and in the capacity of assistant to a Chester architect and surveyor, he became in 1884 an assistant in the Liverpool city engineer's department. Two years later he was appointed chief assistant to the then water engineer of Birkenhead. Subsequently he obtained the position of assistant engineering surveyor in the office of the borough surveyor of Birkenhead, and in 1893 became deputy borough engineer of that town under Mr. Charles Brownridge, his appointment to Worthing following three years later.]

electricity, £53,135; education, £24,621; other purposes, £118,211; total, £228,990.

Main Roads.—Length, 3¼ miles.

District Roads.—Length, 34¼ miles.

District Roads (unadopted).—9½ miles; making a total mileage of streets and roads within the borough of 47 miles.

The principal local industry is that of fruit-growing, and the glass-houses erected in the borough have a total length of 34½ miles.

SEWERAGE AND SEWAGE DISPOSAL.

The whole of the sewage is delivered by gravitation to the sewage pumping station, which is practically adjoining the eastern boundary of the borough. After passing through screens with bars ¾ in. apart, the sewage enters a suction well, where it is lifted by pumps into a delivery chamber connected to six tanks capable of holding a total of 1,000,000 gallons, the top water level of the tanks being 5·5 ft. above high-water mark of O.S.T. The sewage is stored and discharged one hour after high water twice in twenty-four hours through a cast-iron outfall pipe 27 in. in diameter, terminating on the foreshore 350 ft. south of low-water mark of O.S.T.

In 1914 additional pumping plant and new outfall were carried out from designs by the author.

The new outfall is of cast iron, 33 in. in diameter, terminating on the foreshore 200 ft. south of the existing outfall. The new outfall is connected at the sewage works to the old outfall, enabling the tanks to be emptied in less than half the time which was possible with the single outfall. A new pumping station has been erected with two gas engines capable of developing 45 b.h.p. as a maximum working load, and up to 52 b.h.p. as a maximum for short periods, with town gas of 600 b.t.u.'s value, running at a speed of 220 revolutions per minute, and one capable of developing 22-25 b.h.p., running at a speed of 250 revolutions per minute; also two centrifugal Gwynne pumps, one 9 in., delivering 90,000 gallons per hour, and one 12 in., delivering 180,000 gallons per hour. The pumps were originally worked by gas engines, but in 1905, when the refuse destructor was erected, engines driven by steam generated in the burning of house refuse were installed, two gas engines being retained as auxiliaries. A new suction well has been constructed, connected with the main sewer and with the old suction well. The new pumps can be worked in conjunction with the old pumps or independently, so that either plant can be shut down for repairs or other emergency. The south end of the engine-house is of a temporary construction to allow of future pumping accommodation and extension of the building as necessity arises.

The Local Government Board held an inquiry in February, 1913, and sanctioned the sum of £9,383 for the carrying out of the above works, the contractors for which were as follows:—

Laying new outfall, Mr. A. G. Osenton, Horsham.

Pipes, Messrs. The Stanton Ironworks Company, Limited, Nottingham.

Gas engines and Gwynne's centrifugal pumps, Messrs. Davy, Paxman & Co., Limited, Colchester.

Engine-house, pumping chamber, and suction well, Messrs. F. Sandell & Sons, Worthing.

REFUSE DESTRUCTOR.

Movable dustbins are used at each house and the refuse collected twice weekly all the year round by the council's own staff, and disposed of at the refuse destructor, which was erected in 1905 from designs of the author, adjoining the sewage pumping station. The original plant consisted of two cells by Messrs. Heenan & Froude, and two boilers by Messrs. Babcock & Wilcox, Limited. Advantage was taken to use the steam generated in working the sewage pumps, and thus lessen the cost of gas for pumping. Two additional cells by Messrs. Hughes & Stirling were added in 1912. The two plants can be worked independently in order that the cremation of the refuse may not be suspended while necessary repairs are being carried out to either plant. The use of the clinker is dealt with in the description of clinker roadwork.

SURFACE-WATER DRAINAGE.

Separate surface-water drainage from roads only is provided for the greater portion of the borough, the area south of Richmond-road discharging through outlets into the sea at different points, and the portion north of Richmond-road into a natural stream known as the "Teville Stream," running parallel to the railway and delivering into the brooks at the east end of the borough, where the water is discharged through two iron outfalls, each 36 in. in diameter, laid on the foreshore.

One of the above outfalls was constructed in 1914 from designs by the author, the total discharging capacity of the two pipes being 2,250,000 gallons per hour.

The rainwater from roofs of buildings and yard surfaces is connected with house drains and main sewers.

It is estimated that the rainfall from roofs of houses and surfaces of yards during a continuous rainfall of 1¼ in. in nine hours would amount to 2,250,000 gallons, 1 in. of rainfall over the whole of the borough being equal to about 68,000,000 gallons.

WATER SUPPLY.

The water undertaking is owned by the corporation, the water being drawn from a well sunk in the deep chalk at the foot of the South Downs, about 2 miles north of the town, and with the pumping station

* From paper presented at the meeting of the Institution of Municipal and County Engineers held at Worthing on Saturday last.

and reservoir, constructed in 1896, covers about 3½ acres of ground. The reservoir, which is covered, has a capacity of about 2,000,000 gallons, the top water level being 190 ft. above Ordnance Datum. A pair of horizontal compound differential condensing pumping engines, supplied by Messrs. Hathorn, Davy & Co., Leeds, are used alternately, each engine and set of pumps being capable of raising 1,000 gallons of water per minute. The well is sunk to a depth of 37 ft. below Ordnance Datum and 119 ft. below the engine-house floor. The shaft is cased with flanged iron shields in segments from the bottom of the well to within 35 ft. from the surface of the ground, from which point the well is cased with brick in cement backed with Portland cement concrete. Headings 6 ft. by 4 ft. 6 in. are driven in the solid chalk from the bottom of the well, and were extended in 1908, when the author constructed an additional well for the purpose of carrying out the work, the total length of headings now being 255 ft. The cost was £2,050. The solid chalk was found at a height of 20 ft. above Ordnance Datum, and at a depth of 60 ft. from the surface of the ground, the strata above being composed of layers of clay and chalky marl. The average depth of the rest level of water is 57 ft., and when pumping 90 ft. from surface. An analysis of the water was taken some time after the above extension was completed, and the results indicate the water to be of satisfactory chemical and bacterial purity.

In addition to the borough of Worthing, water is supplied to the out parishes of Durrington and Salvington. The annual consumption of water for all purposes recorded by a Venturi meter during the year 1915 was 345,264,200 gallons, making a total consumption of 28 gallons per head per day.

The capital expenditure on the above works and the laying of new water mains is approximately £49,000.

The inclusive charge for water for domestic purposes is 8½d. in the £ on the rateable value, and for trade purposes 1s. per 1,000 gallons.

SEA BATHS.

The corporation salt-water baths were considerably enlarged in 1908 from designs of the author, when a gentlemen's swimming bath 100 ft. by 33 ft. and a ladies' swimming bath 60 ft. by 31 ft. were erected. The original gentlemen's bath, 85 ft. by 37 ft., was reduced in depth, and is now used exclusively by the scholars from the elementary schools. In the winter this building is used by the Miniature Rifle Club. In addition to the swimming baths there are private fresh and sea water slipper and ozone baths for ladies and gentlemen. The baths grounds are used for lawn tennis, having five grass courts and one asphalt court.

ISOLATION HOSPITAL.

The isolation hospital is situated at Durrington, practically on the Downs, about 3 miles north-west of the town. It consists of an administrative block, two ward pavilions designed for fourteen beds each, isolation pavilion for four beds, together with laundry, disinfecting house, and mortuary, the whole covering 11¾ acres. Water is supplied to a small underground tank from the corporation mains, where it is lifted by combined pump and gas engine into a water tower erected at a height to give ample pressure for use in all the buildings. The building used as the administration block was formerly a residence, and the remaining buildings were erected from designs of the author at a cost of £8,000.

SEA DEFENCES.

Worthing has a frontage towards the sea of over 3 miles, protected by the erection of timber groynes, which have successfully withstood the inroads of the sea, rendering the erection of an expensive sea wall unnecessary. The author has constructed during the last twenty years a number of new groynes, all of which have been laid in a south-easterly direction. These have been successful, particularly in one section of the foreshore where right-angled groynes were previously constructed, the result being a greater accumulation of beach for this length than the author has experienced—which is corroborated by old residents.

STREET WIDENINGS.

Many important street widenings have been carried out in recent years, as evidence of a capital sum exceeding £80,000 having been expended between 1892 and 1914, which has materially helped the development of the town.

PUBLIC LIBRARY, MUSEUM AND ART GALLERY.

The above buildings were erected in Chapel-road, and opened in December, 1908. The library, erected at a cost of £6,492, generously defrayed by Mr. Andrew Carnegie, possesses over 13,000 volumes in the lending department, and 4,200 volumes in the reference department. The museum and art gallery, erected at a cost of £4,130, is the gift of the late Alderman Alfred Cortis, the first mayor of the borough. The museum contains one of the finest collections of British birds on the South Coast, also a splendid collection of corals and fine specimens of flint instruments and fossils. The art gallery contains a number of permanent exhibits, and is used for exhibitions of pictures and other art collections.

PARKS AND PLEASURE GROUNDS.

The borough possesses many open spaces. Homefield Park, with an area of 15¾ acres, contains public tennis courts, bowling greens, croquet lawns, cricket and football grounds. Victoria Park, in the north-west, has an area of over 8 acres. Steyne Gardens, about 2½ acres, abutting on the Marine-parade, is laid out with ornamental walks and public tennis courts. Broadwater Green, with an area of about 9½ acres, at the north end of the borough, about 1 mile from Worthing Station, is used for public cricket and football.

Worthing is fortunate that, in the laying-out of the roads, advantage has been taken of the climatic conditions to adopt tree-planting in roads generally, a practice which has been continued by the council as the roads are taken over under the Private Street Works Act 1892.

FIRE BRIGADE.

In normal times the brigade consists of a chief officer and twenty-seven men. A new station was opened in May, 1904, being erected from designs by the author, together with seven firemen's cottages, at a cost of £3,510. The fire station comprises engine-house, recreation-room, and station officer's apartments together with yard and hose-drying tower. A motor fire engine by Dennis Bros., of Guildford, was purchased in 1910 at a cost of £800.

STREET LIGHTING.

The town is lighted partly by gas and partly by electricity. The whole of the gas standards and lanterns are the property of the council, gas only being supplied by the Worthing Gas Light and Coke Company.

The electricity undertaking is the property of the council, under the control of Mr. Geoffrey Porter, ASSOC.M.INST.C.E., electrical engineer. The Lighting Committee pay a proportion of the loan charges, the cost of maintenance, and for the actual current consumed. The generating station and other buildings were erected by direct labour in 1901, and several additions have been made, including the erection of a new chimney shaft from designs prepared by and under the supervision of the author.

ELEMENTARY SCHOOLS.

Three elementary schools and a cookery and manual instruction centre have been erected since the Education Act, 1902, was passed. Since the author was appointed architect to the Education Committee, one new elementary school, at a cost of £6,300, and one cookery and manual instruction centre, at a cost of £1,400, have been erected.

TOWN PLANNING OF GREATER LONDON AFTER THE WAR.

At University College, Gower-street, W.C., on Tuesdays, at 5.30 p.m., beginning on November 7th, Professor S. D. Adshead, M.A., F.R.I.B.A., will deliver a series of six public lectures on "The Town Planning of Greater London After the War." The lectures will be illustrated with lantern slides.

At the first lecture the chair will be taken by Alderman W. Regester, J.P., chairman of the Middlesex County Council, chairman of the Arterial Road Conference of local authorities around London. The chairman of succeeding lectures will be announced later.

Applications for tickets, accompanied by a stamped addressed envelope, should be made to the secretary, Mr. Walter W. Seton, University College.

NOTTINGHAMSHIRE'S ROADS.*

By J. Cracroft Haller,
County Surveyor.

At the commencement of the year ended March 31st last an intimation was received by the Nottinghamshire County Council from the Road Board that, in view of the demand for labour and materials for urgent national requirements, work under the scheme approved in 1914 would only be sanctioned during the year on those roads where the work was necessary to prevent serious deterioration. The scheme referred to provided for the reconstruction of 90 miles of rural main roads and 24 miles of urban main roads, of which, during the year 1914-15, the work on 32 miles of rural main roads and on 12 miles of urban roads had been carried out. It was ultimately agreed by the Road Board that for the year under review 21 miles of rural main roads and about 5 miles of urban main roads should be reconstructed.

The amount of work to be carried out under the Road Board scheme had naturally a great bearing on the amount of the year's estimates. The gross estimated expenditure approved by the county council was £70,640, as against a previous gross expenditure in 1914-15 of £89,975, the difference being principally accounted for by the reduction in the amount of work to be carried out under the reconstruction scheme, the amount provided for the ordinary maintenance being practically the same as in the previous year.

In spite of considerable difficulties in obtaining materials, haulage and labour, the whole of the work contemplated (with the exception of three small footpath improvements) was carried out, the nett expenditure being £41,407, as against a nett expenditure in 1914-15 of £40,737, the increase being accounted for by the cost of surface tarring and repairs to certain sections of the Fosseway amounting to £900.

The policy of the Highways Committee in carrying out the whole of the work provided for in the estimates is one which is to be commended, for in common with practically all other main roads in the country, the roads in this county have had a largely increased amount of traffic placed upon them during the past two years, particularly of the heavy commercial type, in addition to which the main arterial roads in the county have been called upon to carry a very considerable amount of military traffic, and there is no doubt that if the full amount of the work referred to had not been carried out these roads would not now be in their present satisfactory condition.

SURFACE TARRING.

Prior to the commencement of the reconstruction scheme of 1914 there were about 70 miles of roads in the county which had been tarmacked the whole width or down the centre only. The greater portion of these Tarmac sections had not received any surface treatment since they were laid down, and in the hope of extending their life it was decided to tar the surface as much as possible during the year, and 224,750 super. yds., or approximately 25 miles, were surface tarred, at a cost of 1·49d. per super. yard.

There can be no doubt that the result was highly satisfactory, and while no grants were received from the Road Board towards the cost of this work, the importance of it has been appreciated so much that for the present year the Road Board have given a grant amounting to half the cost of the surface tarring carried out.

To carry out the work of surface tarring during the past year it has been necessary to purchase two tar-spraying machines at a cost of £65 11s. 10d. and £70 respectively.

REPAIRS TO RAILWAY COMPANIES' BRIDGE APPROACHES.

From time to time contracts have been entered into with the various railway companies who have railway routes in the county for the repair of the roadway over their bridges and approaches on main roads, and negotiations have been opened with the companies concerned for the repair of those bridges not already contracted for. The result has been that the roadway over the railway bridges on the main roads at Radcliffe and Ollerton, and the canal bridge on the Fosseway at Cropwell Butler, are now being maintained by the council under contract.

DAMAGE TO ROADS BY TRAFFIC TO CAMPS AND MUNITION WORKS.

During the summer of 1915 a large quantity of military traffic made use of a road for the purpose of conveying camp necessaries to certain military encampments. Also in September of that year the erection of a large munition works was commenced, in connection with which an enormous amount of material was hauled over the roads. As many as thirty traction engines and 100 small tractors and motor lorries were used on these roads per day for many months.

At the request of the Road Board, who were acting for the War Department and Ministry of Munitions, the work of the immediate necessary repairs to the roads traversed was carried out by your county surveyor, and the whole of the extra cost incurred was borne by the Ministry of Munitions. In January last, the main road, where it passes through the munition works, was closed by the military authorities, acting under the Defence of the Realm Act, and a new road and bridge is being constructed at a cost of £9,000, for the purpose of diverting the traffic. The extraordinary traffic referred to has now ceased, and a satisfactory scheme for the reinstatement of the roads damaged has been agreed upon.

STEAM ROLLING.

The six steam rollers belonging to the county council have been working throughout the year, and are in good condition. Water sprinklers have been fitted to two of the rollers. These have proved very satisfactory, and it has been decided at an opportune time to fit the remaining four rollers with similar appliances.

In addition to the work carried out by the council's rollers, it has been necessary to hire others. The cost per day of the rollers has been 19s. 9d., as compared with £1 1s. 2d. the previous year, and an average number of 26¼ tons of material was consolidated by each roller per day.

WORK UNDER ROAD BOARD GRANTS.

The construction of the 4½ miles of the Nottingham and Bawtry road, commenced in the year 1914-15, has been completed and the road taken over by the Arnold, Basford and Southwell Councils, in whose districts it is situated. Up to the end of the financial year, out of the 90 miles of rural main roads to be constructed, a total of 53 miles 125 yds. has been completed, and work to the extent of £23,903 has been completed on urban main roads out of a total estimated expenditure of £34,418.

CONSTRUCTION OF ROADS FOR MILITARY.

In October last, at the request of the Road Board, acting for the War Department, the work of construction of camp roads was undertaken. This work, which is estimated to cost £12,000, is nearly completed.

COSTS.

The gross average cost per mile of all roads in the county, including reconstruction under the Road Board scheme, was £154 0s. 9d.; the nett average cost to the county council of all rural main roads was £95 17s. 5d. per mile.

The average prices for road materials supplied during the year were as follows: Tarmac, 14s. 7½d. per ton; granite, 11s. 5¾d. per ton; slag, 7s. 0¼d. per ton.

* Extracts from report for year ended March 31st last.

INSTITUTION OF MUNICIPAL ENGINEERS.

COUNCIL MEETING.

At a meeting of the council held in London on October 25th, three applicants were recommended for admission to corporate-membership.

(Under the by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days.)

From the applicants whose names had been duly published, seven were admitted to membership and one to associate-membership.

Annual Report.—The annual report of council, as drafted by the president and secretary, and the balance-sheet, as prepared by the institution auditors, were approved and ordered to be printed.

Mutual Aid and Defence Fund.—The regulations to govern the administration of this fund were finally approved and ordered to be printed.

Application under Mutual Aid and Defence Fund.—An application was received from a member, and the council decided upon the taking of certain steps.

N.A.L.G.O.—Messrs. Latham, Pegge and Stickland were reappointed delegates.

Institution of Municipal and County Engineers.

MEETING AT WORTHING.

In the absence of the president, Mr. J. S. Brodie, the autumn meeting of the Institution of Municipal and County Engineers at Worthing was taken by one of the vice-presidents, Mr. T. W. A. Hayward (Battersea). The unsettled weather was perhaps instrumental in keeping away a number of members who might otherwise have been present, but when it is remembered that barely a week had elapsed since the arrangements for the gathering had been officially announced, the attendance was by no means a disappointing one, including as it did Messrs. E. Armett (Gillingham), J. Birch (East Ham), E. Wilton Booth (Wallington) H. W. Bowen (West Sussex), Oswald A. Bridges (Bognor), W. Butler (Fareham), J. G. Carey (Hounslow), H. T. Chapman (Kent), district chairman, H. Collins (Colchester), F. Grove (Surrey), E. W. Ingamells (Bournemouth), R. J. Jenkins (Portsmouth), C. W. Leney (East Preston), F. Martin (Worthing), A. MacArthur (Cuckfield Rural), G. Plummer (Haywards Heath), A. E. Prescott (Eastbourne), E. W. Ray-Johnson (Wakefield), D. S. Sutherland (Southgate), H. T. Wakelam (Middlesex), J. A. Webb (Hendon), F. Wilkinson (Deptford), E. Willis (Chiswick), O. E. Winter (Hampstead), G. Porter, borough electrical engineer (Worthing), Councillor W. Aston (Worthing), Councillor T. Start (Bognor), J. Jubb, town clerk (Bognor), H. W. Hiscock (Worthing), Marlow Reed (Middlesex), T. Cole, consultant secretary, and Mrs. Robinson, acting secretary.

The members assembled in the Corporation Art Gallery, and were received by the mayor (Alderman James White, J.P.). Worthing, said His Worship, was not, he was sorry to say, in holiday dress; but he did not know that it was always well when one was inspecting anything that the object of their inspection should be presented to them entirely in rosy colours. For example—a visit to the shore that day would show them big waves tumbling in, and enable them to form something like a correct estimate of the difficulties their engineer had to cope with. The destruction of their pier some years ago would help them to realise that those difficulties were by no means of a light nature; but, happily, their sea defences were, thanks to their engineer, in such a condition that they had no fear that anything disastrous would occur. In the matter of roads, they were grateful and proud of the ability of their engineer in so cleverly manipulating the destructor clinker for use in the surfacing of their highways. He thought they would admit that the surface obtained made for the smoothness and cleanliness which were so essential in a health resort. In Worthing they did all they could to maintain, at all events, a high reputation for cleanliness. For reasons which all would understand, he did not anticipate that they would say the state of everything was ideal, but he believed that, after looking round, they would come to the conclusion that only a very little outlay would be needed at the close of the war to bring them into the condition they would like to occupy.

Mr. Hayward, in taking the chair, returned thanks for the welcome which had been extended to the institution, and made a warm acknowledgment of the gratifying way in which his Worship had spoken of their representative in Worthing, the borough engineer. Mr. Roberts, who had been known to him personally for about a quarter of a century, had been a member of the institution for more than twenty-one years, and they looked upon him as an engineer of no mean ability. As a frequent visitor he (Mr. Hayward) was always pleased to see the splendid way in which the town was maintained. Mr. Roberts had looked after it very well, and the amount of the district rate reflected the highest honour on him, as well as on the authorities.

A paper on

THE PUBLIC WORKS OF WORTHING,

with special reference to tarred-clinker road work, was presented by the borough engineer and surveyor, Mr. Frank Roberts, Assoc.M.Inst.C.E., and produced an interesting discussion. The paper is reproduced elsewhere in this issue.

Mr. H. T. Chapman (Kent) remarked that just as Mr. Roberts had been successful in utilising on the front the local resources in the shape of shingle, and effecting a saving to the town of many thousands of pounds, so he had been able to make use to a certain extent of what had previously been regarded as waste material in the construction of his roads. He had been struck by the fact that the treatment of roads with tar appeared to be more successful in seaside places than in inland towns and rural neighbourhoods. That might be due to the breezes and the greater amount of sunlight; none the less, Mr. Roberts had been most successful in the work he had carried out. They had been told that there was a considerable amount of heavy traffic—motor 'buses—but they had not heard what was the nature of the subsoil on which the roads were constructed. He presumed it was gravel. If so, they had a porous and quick-drying foundation, which, combined with a waterproof surface, made possible the successful treatment of roads with tar of any description. The costs were extremely low, and it was his wish that they could treat their roads in Kent as successfully at the same price. The value of the clinker from the destructor was put at a very low figure indeed, but he supposed that if the corporation disposed of it for other purposes a greater value would be placed upon it.

Mr. H. Collins (Colchester) inquired whether both types of destructors were fitted with trough gates, and, if so, was the refuse properly consumed in the middle? Also were the installations of the back, front, or top feed type? If the types differed, perhaps Mr. Roberts would give them some information as to which he found the best. At the same time, he would like to know the cost of operation per ton of refuse destroyed by each plant, and the quantity of material dealt with. How did these tarred clinker roads compare with tarred slag and tarred granite in regard to slipperiness; and what was the maximum gradient on which they were laid? With regard to the prepared tar, was that prepared in accordance with the No. 2 Specification of the Road Board? Personally, he had experienced a great deal with his road tarring. The cost of the work this year was in excess of that of last year. The tar, he thought, was affected by the refining process being continued to too great a length, and the result was that they were not able to cover so large an area per gallon. Did the cost per square yard quoted in the paper include anything for capital charges?

Mr. A. E. Prescott (Eastbourne) remarked that the appearance of Worthing was in itself evidence of the sound government of the town and of the engineering ability of the borough surveyor. He was afraid that the engineers of seaside resorts were often looked upon as gentlemen with no worries whatever. That was a misconception, however. One of their chief difficulties was that of drainage, and he was pleased to see that at Worthing they had instituted a system of separate drainage with the object of avoiding unnecessary pumping. Mr. Roberts pumped the sewage above high-water mark, and retained it in tanks of a capacity of 1,000,000 gallons. The capacity of the pumps was 270,000 gallons per hour, so that if he had to pump for four hours his tank capacity was exceeded; but when he could discharge by gravitation he supposed that he did not pump at all. He was pleased to see that the steam from the destructors was utilised in connection with the pumping, for it must have effected a considerable economy. In his own case they had saved thousands of tons of coal in that way. Sea defence was another of the worries of the seaside engineer, and a very serious problem indeed. At Worthing they had been eminently successful in retaining a large tract of shingle. He considered, however, that permanent benefit could only be secured by a combination of sea wall and groynes. The results of the Royal Commission on Coast Erosion were not at all satisfactory. It was hoped that many of the small seaside resorts would receive a substantial grant from the Government to help them with this serious problem, but they were doomed to disappointment. He was interested in the tarred clinker roads. He remembered inspecting Mr. Roberts' depot some years ago, and was not then convinced that what he saw warranted him following his example; but he thought the roads he had laid in the last two or three years

were very excellent indeed, the motor-'bus traffic which they carried being a good test of their efficacy.

Mr. E. W. Booth (Wallington) said he had considerable experience some years ago at Croydon with a waterworks exactly similar to that at Worthing. The Croydon people put down a differential condensing engine in 1876, and it had been doing excellent work ever since. There had been times when Croydon was on a hand-to-mouth supply and had to depend on that engine, which, however, never failed them. What duty did Mr. Roberts get from his engine per cube foot of coal burnt on test? The figures for the test on the completion of the works and those obtainable on test now would be very useful. What was the lift to the reservoir? Also what were the respective depths in the old and new wells? At Shirley they sank two wells of 240 ft. and 368 ft., and found that the yield was the same from both. The Worthing waterworks were 2 miles back from the sea, and the pumping line of the water was below sea-level, but he supposed they had some overlying strata, and did not draw any brine from the sea. As regarded the rest-level, that was given as 57 ft. and when pumping as 99 ft. How long did it take after pumping had ceased for the level to return to 57 ft.? Then could Mr. Roberts give some information as to whether any steps had been taken towards the treatment of the water by softening or any process of sterilisation? No bacilli coli had been found in the bacterial examination of the water. Had there been any trouble with bacilli coli after heavy rains—that was to say, were there any soak-aways that caused any cloudiness in the water? The consumption of water was 28 gallons per head per day, but the explanation of that low figure probably was that the street watering was done with sea water.

Mr. Oswald A. Bridges (Bognor), in paying a tribute to the excellence of Mr. Roberts' work, asked whether the latter had used armoured concrete in the construction of his groynes on the Case system. Also, with reference to the sewage system, had he any overflow to get rid of?

Mr. E. Willis (Chiswick) pointed out that Mr. Roberts had not mentioned the dry-weather flow, but he assumed it was somewhere about 700,000 gallons per day. The question of the size of the tank would, of course, be affected by that. In connection with the clinker, he would like to know whether it was essential that the material should not be used for a period of two or three months. He had been making this clinker for two years, and he did not start on the same lines. Recently he had been using the clinker within a week or two of making it, and up to the present there had been no difference in the wearing power of the samples put down. There was one slight difference in his practice. He had been using a small quantity of lias lime. He did not know whether it was absolutely necessary, and possibly it would be an economy to do without it, but certainly the results had been good. He considered Worthing was to be congratulated on the chemical analysis of the water supplied to the town, especially as regarded the permanent hardness.

Mr. F. Grove (Surrey) said he was more particularly interested in that part of the paper dealing with tarred-clinker roads. Had Mr. Roberts used this material on any important roads with a considerable amount of through or foreign traffic? Could he give them any traffic statistics on any of the roads on which it was laid? Was it capable of withstanding any considerable amount of omnibus traffic? The quantity of matrix which was formerly used in the first mixing appeared to be somewhat large—6 gallons of tar, 1 gallon of oil, and 2½ gallons of pitch, total, 9½ gallons, to half a cube yard. Probably this was necessary owing to the porosity of the clinker. They only used 10 gallons of pitch and oil for their macadam base and coat. It would be interesting to know the weight of a cube yard of clinker before mixing with the matrix, to compare with the weight of the finished product. By prepared tar did Mr. Roberts mean dehydrated or distilled tar, and in the same quantity as formerly—viz., 9½ gallons to half a cube yard? The consolidation was rather great, compared with slag or other tar-macadams. Taking the covering capacity at 10¼ sq. yds., the cost (including surface tarring) worked out at 10s. per cube yard laid complete, which was very cheap. In the paragraph in which Mr. Roberts resented having been told that the traffic in Worthing was not heavy, he spoke of a continuous service of motor omnibuses. Did they run all the year round or only in summer? While on the subject of omnibus traffic—a very burning question at the present time—could Mr. Roberts tell them to what extent the main and important roads were affected thereby? Finally, had any consents been given for the institution of any new service since the passing of the Local Government (Emergency Provisions) Act, and, if so, upon what conditions?

Mr. H. W. Bowen (West Sussex), speaking with regard to the tarred-clinker roads, observed that these carried heavy traffic, and at the price were the very best roads he had seen constructed in his life. It was laid on part of the main county road running through Worthing, and carried constant heavy traffic year in and year out—motor 'buses and traction engines. As regarded price, he was quite convinced Mr. Roberts had quoted a fair figure, knowing what he charged for what he supplied to the county council. He had had excellent results from it.

Mr. J. Birch (East Ham) stated that he had made use of tarred clinker himself. One would like to know the quantity of tar Mr. Roberts used with the fine clinker as compared with that used in the large clinker. He had found that the smaller took considerably more than the larger clinker, and had tended somewhat to increase the cost. What was the rate of wages in Worthing? At East Ham it was 9d. per hour, and horse hire was 10d. Finally, did Mr. Roberts heat his clinker before tarring?

Mr. H. T. Wakelam (Middlesex) remarked that it would be interesting to hear Mr. Roberts' reply to Mr. Chapman's question as to the subsoil of his roads. In making use of tarred material the foundation had, of course, a great deal to do with its success. Mr. Willis had asked whether the tarred material was allowed to mature or not. After some years' experience in that connection, he thought it was far better to allow the material to mature than to lay it as soon as mixed.

Mr. R. J. Jenkins (Portsmouth) inquired whether any special means were used in opening the valves of the sewage collection tanks. (Mr. Roberts: It is done by hand.) Was any trouble experienced in keeping sand and seaweed out of the sea-water baths, and was there any vegetable growth at the bottom of the tank?

Mr. O. E. Winter (Hampstead) said the paper came at an extremely opportune time for those with destructors who had difficulty in disposing of their clinker. Clinker was not so much in demand now for building purposes, and there were many who would be glad to learn of a means of getting rid of it. No doubt a great deal of the success in road construction achieved at Worthing was due to the suitable foundation; at the same time it was well worth their while to utilise this clinker in side streets that did not carry heavy traffic. At Hornsey crushed clinker mixed with bitumen was being made use of, and the roads laid seemed both economical and good. Existing conditions had compelled him to make use of small clinker in connection with the tar-dressing of roads. Used alone the colour of the material would be somewhat against it as compared with shingle or sand, but he had used a small proportion of the latter materials with the clinker and found it satisfactory. He had used it on Jarrah-paved roads with good results, and during the winter months he had employed it for gritting purposes on roads with steep gradients and smooth-paved roads.

Mr. F. Wilkinson (Deptford) asked what length of main roads was done with tarred clinker, and what length of district roads. Also, what was the price of granite chippings in Worthing at the present time?

Mr. J. A. Webb (Hendon) inquired whether Mr. Roberts found it necessary to use more tar in the tar-surfacing of clinker roads as compared with the ordinary water-bound macadam roads. Also what weight of roller was used in consolidating the material, and did he find it crush in some places more than others?

The Chairman, in closing the discussion, observed that three county surveyors had expressed most favourable opinions on Mr. Roberts' methods, and Worthing ought to feel proud of its engineer.

Mr. Roberts, in replying to a number of the points raised in the course of the discussion, first dealt with Mr. Chapman's observation with regard to the low costs of the road work. The material was 9d. per load. The subsoil was gravel and clay, and he was surprised, in view of the clay, that they had such good results. The clay was not on the surface, but in some places there was a bigger depth of gravel than in others. He had put down a slip of tarred clinker in between water-bound granite, and it remained for two years without showing the slightest alteration of the surface,

whereas the tar-painted water-bound granite on either side of the clinker showed signs of breaking loose. It was therefore really better than the granite. The destructor furnaces were not fitted with trough grates. They were back-fed by hand. The lift of the pumps was 15 ft. They had a surface-water overflow, but it could only be used at very low water. The dry-weather flow was about 800,000 gallons. In answer to Mr. Willis, he had used no lime, though he had been thinking about it. It was, however, just as well if they could do without it. Mr. Birch was quite right; the small clinker took more tar than the large. They paid 6d. per hour to the men. The clinker was not heated; it was dealt with straight from the destructor. The process was quite a simple one, with nothing special about it. The roller was one of 10 tons. Mr. Roberts mentioned that he would reply to Mr. Booth's questions in writing.

After luncheon visits were paid to a number of the works described in the paper, and before separating the members were entertained to tea by the borough engineer and the town clerk.

THE EMPLOYMENT OF CONSCIENTIOUS OBJECTORS.

URBAN SURVEYOR AND "THE RIGHT TO LIVE."

At the last meeting of the Risca, Monmouthshire, Urban District Council, there was an animated discussion as to the employment of a conscientious objector.

Mr. F. Jones said there was a rumour in the district that a conscientious objector had been employed by the council. There was a good deal of feeling about it, and he would like to know if it was the truth.

The surveyor (Mr. A. J. Dardis) said it was true. This man applied to him for work, and as he wanted men he put him on. The man told him that Mr. Brace had told him to get what work he could until he was called up.

Mr. Jones said he felt very strongly upon this point. Here was a man who objected to fight the battles of his country, and yet he was prepared to come into the service of the council, take the war bonus which the council were giving, take advantage of the sacrifices which his fellow-men had made, and earn his livelihood in safety at home while his comrades were fighting in the trenches.

The surveyor: Is a man to suffer sentence of death because he is a conscientious objector? He had paid the penalty of it.

Mr. F. Jones said the point was that some time ago the council released a married man for the Service, and this conscientious objector was taking his place.

The chairman said that some time ago they held a special meeting of the council to comb out as many of their employees as possible to join the Army. Yet after they had done this they had the surveyor appointing a man who now filled the place of a married man with children who had gone to the Colours. He thought the surveyor was very much to blame in appointing this man, especially seeing the feeling that there was in the district on the subject.

A MAN AND HIS CONSCIENCE.

The surveyor: You may consider me to blame, but I had to carry out certain work, and I wanted men to do it. I did not, and I never have since I have been in the service of the council, stopped to inquire what a man's views were on anything, his politics or anything else. The man came to me, said that he was out of work, and wanted employment. I wanted men, and I employed him. I acted conscientiously, and I do not feel ashamed of what I have done. That man has a right to live as well as other people. If you take a different view of it, and say that the man shall not be employed, well you must take the onus. Because this man has a conscience, and has a conscientious objection to taking other men's lives is no reason why he should not live. I do not take the attitude of judging between a man and his conscience.

Mr. F. Jones said that Mr. Dardis might be conscientious, and prior to the war the attitude he took up might be understood. Here was a man, however, who deliberately asked the council to employ him after he had refused to fight his country's battles. This man was prepared to take advantage of the sacrifices which other men had made. Why did not this man, who was an insurance agent, apply to his previous employers for work? He moved that the man's services be dispensed with.

The chairman said that the surveyor had put up what he considered an extraordinary defence. The point was that they had combed out married men, and yet this man, who said he had a conscientious objection, was employed.

The surveyor: The Central Tribunal have come to the conclusion that they have a real conscientious objection.

The chairman: They may be right and we may be wrong. This man has been to prison, and has been released on the stipulation that he should obtain work of national importance.

The surveyor said that the fact was that the Government were not quite ready to proceed with works that they wanted to do, and in the meantime this man had to live or else become a burden on the rates, or someone.

A member suggested that, now the surveyor had heard the expression of the council's opinions, the matter be left to him.

The surveyor said that under the circumstances he preferred the council to take the responsibility.

Mr. Powell: Who created the difficulty?

The chairman: The surveyor.

Mr. Pritchard said that the council had given an undertaking to re-employ their own employees when they came back from the war, and if it was necessary they should put off works to be done after the war so that they might have work to offer them. He thought, too, that the insurance companies who had given similar undertakings should do the same.

Mr. E. Edmunds seconded the resolution that this man's services be dispensed with.

Mr. Powell said they did not want to be judges of another man's conscience, but he would never be a party to dispensing with the council's own employees to employ single men outside.

The resolution was then carried.

WILTSHIRE SURVEYORS' ASSOCIATION.

ANNUAL MEETING AT TROWBRIDGE.

The annual meeting of the Wiltshire Surveyors' Association was held at the Town Hall, Trowbridge, on Saturday last, the attendance including Messrs. J. George Powell, county surveyor (in the chair), W. H. Stanley (Trowbridge), chairman of council, J. W. Brooke (Marlborough), H. G. Nicholson-Lailey (Trowbridge), A. O. Crew (Devizes), F. G. Billingham (Devizes), S. Saunders (Devizes), A. G. M. Cross (Westbury), A. E. Adams (Chippenham), and E. Plummer Davies (Tisbury), hon. secretary. Letters regretting inability to attend were received from Messrs. A. F. Long (Warminster), G. Drewett (Calne), Mr. J. Godfrey (Calne Rural), and A. H. Lapham (Corsham).

The officers and council were re-elected.

An interesting paper, entitled "Geology and Its Influence on Settlements," was read by Mr. J. W. Brooke. The paper being so full of points, discussion was deferred to a future meeting.

On the motion of Mr. Nicholson-Lailey, seconded by the president, hearty thanks were accorded to Mr. Brooke for his paper.

Tea was partaken of at the invitation of the president, this closing a most instructive meeting.

REINFORCED ROAD CONSTRUCTION IN DUNFERMLINE.

The B.R.C. Fabric of the British Reinforced Concrete Engineering Company is being employed in the reinforcement of the road surface of Canmore-street, Dunfermline, a thoroughfare carrying a considerable amount of heavy motor-'bus traffic. Although the use of concrete for street purposes is no novelty there, this particular method of reinforcement would appear to be new so far as Scotland is concerned, and considerable interest has been taken in the operations by the engineers of other Scottish towns.

The work is being carried out by direct labour, under the personal supervision of the burgh engineer, Mr. P. C. Smith, and his staff.

Institution of Civil Engineers.—The first ordinary meeting of the session will be held on Tuesday next, at 5.30 p.m., when the president, Sir Maurice Fitzmaurice, C.M.G., will deliver an address, and the presentation of medals awarded by the council will take place.

Road Maintenance in Cumberland.*

By WILLIAM FINCH, County Surveyor and Bridgemaster.

During the year every effort was made to minimise the expenditure on the main roads of Cumberland, with due regard to efficiency, and only such work was carried out that was considered absolutely necessary to keep the roads in a satisfactory condition.

The average cost per mile on the total expenditure, including surface improvement works, was £86 5s. 7d., as compared with £94 13s. 10d. last year. Deducting Road Board and other receipts, the average cost has been £75 17s. 9d. per mile to the council, as compared with £79 19s. 4d. last year, and £74 13s. 11d. the previous year.

ROAD SURFACES.

Owing to the war the amount of motor traffic during the year has been somewhat decreased in most parts of the county, and in consequence that rapid deterioration of the weaker surface crusts which has been noticed hitherto has not been quite so extensive during this year. A certain amount of damage, however, was done to the roads owing to the very heavy rain and snowfalls during the earlier part of the year, especially on those surfaces which had not been tar treated.

In the Carlisle and Longtown districts, however, as well as on the London main road, the traffic of every description has considerably increased, both in volume and weight, with the result that those surfaces that had been metalled hitherto with local hand-broken stone were entirely destroyed, and even the stronger surfaces considerably damaged.

It is interesting to note that the tar-macadam surfaces in Longtown, and at The Guards, on the Glasgow main road, have stood this heavy traffic remarkably well, and require very slight repairs.

RESURFACING WORK.

During the year resurfacing work has been carried out on those sections of roads only which were urgently in need of such work, and where the surface crust had practically worn through, other weak sections being left over for another year. I am firmly of opinion, however, that it is mistaken economy to allow those roads where the surface crusts are showing signs of weakness to go too long before renewing the surface coat, as once the crown has worn away it is a far greater expense again to form the road to a proper contour.

During the year there have been 135,494 sq. yds. of granite or whinstone surfacing laid, at a total cost of £9,226 4s. 10d., or 1s. 5·08d. per yard, in comparison with 204,472 yds., costing £13,070 13s. 1d., or 1s. 3·3d. per yard, during the previous year. It will be noticed that the average cost of such surfacing this year is increased by 1·78d. per yard, mainly due to the increased prices in material, labour and horse haulage.

The scheme of surfacing the whole of the main roads with first-class material, in lieu of inferior local stone, was continued; the Road Board grant towards this expenditure was £2,691, leaving a nett cost to the council of £6,535 4s. 10d. In connection with this work 15,075 tons of granite or whinstone were used, at an average cost over the whole county of 6s. 7d. per ton, delivered to the nearest railway station, this being 1¼d. per ton in excess of the previous year.

TAR-MACADAM.

The area of tarred granite-macadam laid during the year was 28,327 sq. yds., as compared with 66,278 during the previous year. The total cost of this work was £3,718 8s. 3d., towards which the Road Board made a grant of £1,583. The price per square yard works out at 2s. 7·5d., as compared with 2s. 6d. per square yard in the previous year.

The quantity of tarred granite used was 4,155 tons, at an average cost of 12s. 9d. per ton, delivered at the nearest railway stations, as compared with 12s. 10d. per ton last year, the reduction of 1d. being accounted for by the fact that most of the work was carried out nearer the quarries, involving a less railway rate.

With the exception of two sections at Kingstown, on the Carlisle to Edinburgh and Glasgow main road, which were laid in 1910-11, the various lengths of tar-macadam are still in a very satisfactory condition.

SURFACE TARRING.

After careful observation through another winter of the water-bound surfaces that have been treated with tar, I must still advocate very strongly the extension of this treatment on the county main roads.

During the year I have used both refined tar and Tarco upon the surfaces of various lengths of roads in the county, including all those sections of roads that were resurfaced with first-class material in 1914-15 by the aid of Road Board grants. The average cost was about 1·59d. per square yard.

TRENCH OPENINGS.

During the year sanction has been granted for fifty trench openings in the county rural main roads by various local authorities and contractors, and in most cases the surfaces have been satisfactorily reinstated. Where tar-macadam surfaces have been broken into, arrangements have been made as heretofore for the reinstatement of the surfaces by the county council's workmen, the cost being charged to the persons opening. As pointed out in my previous reports, this is a far more satisfactory means of ensuring that the road surfaces are properly reinstated, and I am of opinion that it is a system that should be extended to all trench openings, fixing a charge per super. yard for reinstatement of the various classes of road surfaces.

THE SUPPLY OF GRITTING MATERIAL.

When breaking stone with the council's breakers a large quantity of small stone from ¾-in. to 1-in. gauge accumulates, for which there is not much use, and with the existing machinery it is impossible to break it to a smaller size. A large amount of small grit from ⅜-in. to ½-in. gauge is required in connection with surface tarring, and considerable difficulty has been experienced in obtaining deliveries of this material from the various quarries at the time it is required. I am therefore of opinion that it would be a considerable advantage to the council if granulators were installed at their quarries, in order that this accumulation of small gauge stone could be ground to a smaller size, and used in connection with the work upon your roads. I am of opinion that a large quantity of very good grit could be obtained in this way at a small cost.

URBAN MAIN ROADS.

As the existing agreements for the maintenance of the main roads with the various urban authorities in the county ceased at the end of the last financial year, the question of the future maintenance and annual payments has had the careful consideration of the Highways and Bridges Committee, and it was resolved that for the present no further agreements be entered into with the various urban councils.

On estimates being submitted of the cost of maintenance of the main roads within the urban areas for the year, the committee fixed a maximum sum which they would grant to each urban council for the expenditure on such roads during the year, with a request that such expenditure should be kept as low as possible, with due regard to efficiency; further, that detailed particulars of expenditure should be submitted before any payments were made.

With regard to the system of fixing a maximum amount at the commencement of each year upon an estimate of the work that is required in lieu of triennial or quinquennial agreements, I am of opinion that it will tend to give more satisfactory results on the urban main roads, as, although the submitting of detailed statements of accounts entails extra work upon the urban surveyors, by having an approved estimate at the beginning of the year, they are able to work more in conjunction with the wishes of the council.

LABOUR DIFFICULTIES.

During the year the question of labour upon the main roads has been one of considerable difficulty. Owing to the large number of men required on Government works in the county (for which the Government have fixed a considerably higher rate of wages than hitherto paid in this county), and the

* Extracts from county surveyor's fourth annual report on the main roads, bridge roads and bridges in the county of Cumberland. At the end of March last the mileage of rural main roads under direct control of the county council was nearly 456½ miles.

The Surveyor
And Municipal and County Engineer.

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demands of the Army it has become practically impossible to obtain any casual labour at all, and it is now necessary, in order to carry out the work on the roads, to obtain gangs of men by bringing the council's regular men considerable distances from their homes and regular lengths of road, giving them lodging allowance, and in many cases an increased wage. By this means it has been possible to carry out the greater portion of the resurfacing work, but by so doing it is impossible for the roads to have that continual attention as hitherto.

Further, although the council granted 2s. 6d. per week war bonus to the roadmen last year, continual applications have been received during the year for further increases, the main reason given being the continual increase in the price of all food commodities. In view of these applications, and the high rate of wages that were obtainable on Government work, the committee resolved to abandon the existing scale of wages during the war, leaving the matter for me to make the best arrangements possible in this respect.

It is somewhat fortunate, from the roads point of view, that the majority of the regular roadmen are at present over the military age, as I feel certain that should there be any further shortage it would become practically impossible to keep the road surfaces from considerable deterioration.

I am pleased to be able to report that the roadmen, although in many cases at considerable inconvenience to themselves in having to be away from their home for some considerable length of time, have been only too willing to do all they can in carrying out the work during these difficult times.

Housing and Tuberculosis.—At a meeting of the Southport Insurance Committee on Wednesday the housing conditions of that town came in for strong criticism during a discussion on the after-care of tuberculosis patients. Mr. J. Gordon, the chairman, who is one of the Insurance Commissioners, said that closely allied with the subject of tuberculosis was that of housing, and he was afraid the question was more acute in Southport than its civic rulers were aware. He thought if they knew how acute it was they would bestir themselves. He was exceedingly sorry, in reading the monthly reports of the town council, to see how the question was treated when it cropped up. There were plenty of large houses from £30 upwards, but there was great scarcity of houses with weekly rentals at from 5s. to 7s. 6d. If the by-laws were too exacting, then the town council ought to see that those by-laws were made sufficiently elastic, and if the conditions of landowners were too stringent, they ought to create public opinion which would cause them to be more moderate in their demands.

STEAM MOTOR HAULAGE.

WORKING COSTS IN CUMBERLAND.

The question of haulage by team labour in Cumberland has, says Mr. William Finch, the county surveyor, in his fourth annual report, throughout the year, been a most difficult one, causing considerable difficulty in organising the work, and during the present time there appears to be little hope of any improvement in this respect. Owing to the shortage of labour on the farms it is now almost an impossibility to hire horses and carts from the various farmers who have hitherto undertaken this work. Moreover, where carts have been obtained, it has been found necessary to increase the rates of hire all over the county.

This may be seen from the fact that, although the expenditure on resurfacing work was considerably less this year than in the previous year by some £3,800, the cost of team labour during the year has been £6,950 2s. 9d., as compared with £7,723 10s. 2d. the previous year, or only a decrease of £773 7s. 6d. In some districts, however, this difficulty has been largely overcome by the use of the council's two 5-ton steam tractors and the hire of others.

During the year a record has been kept of the detailed cost of working the council's steam tractors, together with the mileage travelled, and the following are the details of a full twelve months' working of No. 1 tractor:—

Tonnage hauled		2,972	tons
Mileage hauled		1,740	,,
(being one-half of the total distance travelled).			
Average mileage per journey 3·5 miles.			
Cost of repairs and maintenance...	£15	14	2
Cost of fuel	55	8	4
Wages of driver and man...	157	17	5
Insurance	18	12	6
15 per cent depreciation on cost of tractor and wagons (15 per cent on £550 18s. 9d.)	81	19	3
Total cost	£329	11	8

Hence during the twelve months it has been at work the steam tractor has hauled 2,972 tons a distance of 1,740 miles, the average distance per journey being 3·5 miles, at a cost of £329 11s. 8d., which gives an average cost to the council of 7·6d. per ton per mile. The average cost for hired horse haulage is now approximately 10d. per ton per mile. A considerable saving has therefore been effected, and the county surveyor strongly recommends the purchase of two more tractors and four wagons as early as convenient.

NOTTINGHAMSHIRE FIGURES.

Early in the year, states Mr. J. Craeroft Haller, the county surveyor of Nottinghamshire, in his annual report, owing to the shortage of labour and horses, and the high prices charged for mechanical haulage, the question of haulage of materials became somewhat acute. A special report was made to the Highways Committee, when it was agreed to purchase a steam tipping wagon and two trailers at a cost of £800. These were delivered in October, 1915. The short period that this wagon worked up to the end of the financial year can hardly be taken as a basis for arriving at a definite statement of cost, but after allowing for depreciation at the rate of 12½ per cent. and including the whole of the working expenses, the cost of hauling the material dealt with was only 3½d. per ton per mile.

It is not expected that this low rate will be maintained, but there is no reason to doubt that the haulage will be carried out within the rate of 5d. per ton per mile, which was the rate put before the committee before they decided to purchase. The result has been so satisfactory that since the end of the financial year another steam wagon and two trailers have been purchased at a cost of £850, the Road Board having granted a loan, free of interest, for the purpose.

A Case of Indispensability.—A well-known Chicago consulting engineer writes: "Some time ago I ordered you to discontinue my subscription, but I have concluded that I must continue the paper. Will you therefore kindly continue my subscription and send me invoice."

LONDON ARTERIAL ROADS SCHEME.

"NO IMMEDIATE PROSPECT OF REALISATION."

The scheme of arterial roads for Greater London, which was drawn up in the early part of the present year as a result of a series of conferences on the subject, was laid before Mr. Walter Long, the President of the Local Government Board, on Wednesday, by a deputation of representatives of public and professional bodies interested in the proposals. Mr. Long was accompanied by Mr. W. Hayes Fisher, M.P., Parliamentary Secretary of the Local Government Board, and Sir George Gibb, chairman, and Mr. W. Rees Jeffreys, secretary of the Road Board.

Alderman W. Regester, chairman of the Middlesex County Council, in introducing the deputation, said they did not ask that money should be expended on that or on any other object save that of the prosecution of the war to a victorious conclusion, but England would have a future, and it was to bring about the future construction of these roads that the deputation came before the President.

Sir Aston Webb, speaking on behalf of the Royal Institute of British Architects and the London Society, said the whole of London had been taken into account, and the conference had come to an almost unanimous approval of the proposed roads originally laid down by the Traffic Branch of the Board of Trade. The deputation did not expect that money should be spent at present, but it was of great importance that the course of these roads should be laid down authoritatively, so that town-planning schemes all round London might be developed in accordance with the scheme. The congestion of traffic had been considered, and the conference also realised that the military authorities might require additional roads. They were also of opinion that one of the means of solving the housing problem was to make free communication, so that people could be lodged outside London rather than be herded together in large buildings in the centre.

Sir Alexander Stenning urged the necessity of a central authority being established to carry on the work of the conferences. The Surveyors' Institution, which he represented, would use its influence with landowners, many of whom would be willing to give without compensation the land that would be required for the construction of the new roads.

Mr. F. M. Elgood, ex-chairman of the Ruislip-Northwood Urban District Council, stated that 137 local authorities and twelve other bodies keenly interested in the subject had been represented at the conferences, and a unanimous and emphatic conclusion had been arrived at as to what new roads and improvement of existing roads were necessary. Railway congestion during these critical times had still more emphasised the importance of good roads, not only for ordinary transport, but for strategical reasons, and no more suitable or more productive schemes could be formulated for employing large bodies of men during the readjustment of the labour market after the war. Of the 130 miles of road recommended by the conference, approximately 109 miles would pass through open country, which might get quickly built upon unless the routes were fixed, but the cost of the remaining 21 miles was not likely to be much greater in the near future. What was clearly needed in order to obtain the co-operation of local authorities and landowners under town-planning schemes was that the central authority should support the findings of the conference and undertake: (1) To guarantee the local authorities against claims under the Act for compensation by landowners in respect of laying down the lines of the roads of a width greater than that required by local by-laws; and (2) to guarantee the local authorities, and through them the landowners, against having to bear a greater cost for road construction than that required by the local by-laws. With such guarantees, it might confidently be expected that all local authorities would be willing to fall into line and carry out by town-planning schemes the conclusions of the conference.

MR. LONG'S REPLY.

Mr. Long, in reply, said the situation really turned upon one question, and one question alone. When the conference met a short time ago with a view to adopting their report he called attention to the great changes which had taken place since they had embarked on their work, and if what he then said was true, it was still more true at the present time. They were obliged, all of them, whether in the Government or out of it, to think solely of the war and its successful prosecution as the one object of their lives. It was almost impossible to find time adequately to discuss these problems with their advisers, and to give anything like properly considered replies. The strain of work connected with the prosecution of the war took the whole of their time and strength, and he was not ashamed to say there, as he had said in the House of Commons, that until they could see more daylight than they saw at present with regard to the termination of the war, he regarded himself, as a public servant, as bound in honour and duty to give all the time and strength he had got to war work, and let anything else stand on one side, at all events for the present. They were all agreed that it was desirable to have great arterial roads serving the traffic in and out of London, and that these roads should be made on more common-sense and definite principles than in the old days, and that regard should be had not merely to the utility of the scheme as a means of transit and transport for the country generally, but to the work of town-planning, and, as far as possible, to the amenities and æsthetic beauty of the various parts of the country in which they were situated. They had first to consider the legislation that would be necessary to give the admirable results of the conference the push which they required. Before the Government could make any statement on that side of the question, it was surely necessary to ask themselves what position they were in to give any guarantees at all. What this really meant in the long run was money. It all came back to a guarantee which would be estimated in terms of money. He had warned the conference before that, as things were now, it was impossible for the Government to forecast what money would be available when the war was over. Even if the Government could find the money, it would be impossible to expend it when labour was wanted for other work of a more pressing character. What he had to do was to find some machinery by which they could avoid the labours of the conference being in vain, and be able to take some step in advance when peace came. All he thought he could do at the moment was to ask Sir George Gibb, as head of the Road Board, to examine the scheme of arterial roads at which the conference had arrived, and to report as to the relative importance of the different proposals. He was afraid there was no immediate prospect of the realisation of the hopes which the conference entertained, and which they all shared, but as any guarantee which might be given to them must be dependent on the provision of funds, he thought it was all that could be done at the moment. There were other public needs which had been hindered in the most lamentable way by the war, and he did not hesitate to say that if he was Minister there at the termination of the war it would be his duty to advise the Government that the first call upon Government funds ought to be for the provision of housing for their people in the country, and for sanitation and water supply, without which, of course, housing was of little value.

Cardiganshire Roads: A Committee's Report.—Cardiganshire County Council have approved the report of the Northern Roads Committee, in which it was suggested that steps should be taken to prevent permanent buildings on the roadside making it difficult in future to widen roads, and that by-laws for that purpose should be drawn up. Roads where traffic is exceptionally heavy were too narrow, and steps should be taken gradually to bring all roads to a minimum width of 20 ft., especially at corners. North Wales road metal should be used freely, and an attempt should be made to discover local stone of better quality. The committee were favourably impressed with the organisation of workmen on the northern section. Some of the workmen were not of the type the council could demand, in view of wages paid and regular employment. The fact that the same wages were given to all men did not attract the best type of men, as the standard of work was necessarily lowered to that of the least capable workman. The same amount of work could not be expected from a man of seventy as from one of thirty or forty, but all were paid the same wage. There was a lack of active supervision, owing to the surveyor having a large district and a considerable amount of office work to do. The surveyor should be relieved of office work as far as possible, and should spend the whole of his time on the roads. In some places workmen's houses were inconveniently situated in relation to roads under their charge. The council should purchase or hire more convenient cottages.

Law Notes.

EDITED BY J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

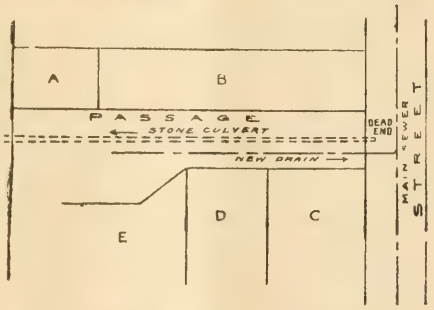
BUILDING LINE.—"H. F." writes: I should be very glad to receive your advice upon the following matter. A plan was submitted to the council for a residence in a road now being built up and known as V Avenue. The proposed house A was shown on the block plan in line with the adjoining house B. A note, however, was added to the plan by the owner, stating that he desired to bring out his house A in line with houses C lower down, and divided from A and B by a side street, and claiming as he also owned B, no objection could be raised in regard to that house. In reporting to my committee, I recommend that the line of frontage of the proposed house A was governed by B, and not by C, but I am not yet certain whether the council has ever definitely fixed the line of frontage upon any plan in regard to this road. I am of opinion that the matter is governed completely by sec. 3 of the Public Health (Buildings in Streets) Act, 1888. The council have a private Act of Parliament (1914), in which it states, sec. 62 (1): "Where any street or road in the district reparable by the inhabitants at large is, in the opinion of the council, narrow or inconvenient or without any sufficiently regular line of frontage, or where, in their opinion, it is necessary or desirable that the line of frontage should be altered, the council may from time to time prescribe and define what shall thereafter be the line of frontage to be observed on either side of such street or road." The line which in any case the council propose so to prescribe and define shall be distinctly marked and shown on a plan to be signed by the chairman of the council, or by the clerk, and deposited with the surveyor, and such plan shall be at all reasonable times thereafter open for the inspection of the public without charge, and one month at least before the council formally prescribe and define the line they shall give notice in writing of the deposit of the said plan to every owner interested whose name and address they can ascertain, and in cases where such name and address cannot be ascertained by affixing such notice to or on the premises. No new building, erection, excavation, or obstruction (being of a permanent character) shall be made nearer to the centre of the street or road than such line." I should be very glad to have your advice upon this question, and to know whether you consider the owner should adhere to the line of frontage fixed by B.

Unless the council have prescribed and defined a building line under the power given by their private Act the case is governed by the Public Health (Buildings in Streets) Act, 1888, sec. 4. Under that Act the proposed house A cannot lawfully be brought forward (without the consent of the council) beyond the front main wall of the house on *either* side thereof. It appears from the plan that the houses on the two sides of A are B and C. It is clear, therefore, in my opinion, that it would be a contravention of the Act to bring A forward (without the consent of the council) beyond the front main wall of *either* B *or* C, see *Anderson* v. *Richards* (70 J.P., 23). And, inasmuch as C is further forward than B, the latter, in effect, sets the line for A. The ownership of B has nothing to do with the question.

COMBINED DRAINAGE: FLOODING.—"H. H." writes: I would be greatly obliged if you will kindly answer me the following questions in the statement below as to who has the responsibility of drain and drainage from house and shop property as is in my case—viz.: I am the owner of three houses and shops built about thirteen years ago and planned by the architect who is now surveyor to this council. A new sewerage scheme was carried out about eight years ago and proper connections made to the main sewer. During the last two years a colliery village of about 213 houses, with water-closets, has been erected, and the greater part of the sewerage and rain-water off this newly paved area has been connected into the same main sewer as my property. The consequence is that when there is a fairly heavy rain the main sewer, which is a 9-in. one, gets choked up through having to take the extra amount from all these new houses, and therefore backs up my drains and floods the yard and houses. It has occurred twice during the last three months, causing great loss and inconvenience. I am given to understand that the onus of blame rests on me, and not on the council. These being three houses belonging to one owner, does it make my drain a sewer, and under the responsibility of the local authority? The trouble has only arisen since these houses have been erected, as the property was only once before flooded, that being on the occasion of a very exceptional thunderstorm, when the streets were several feet deep in water.

In my opinion the combined drain is a "sewer," vested in and repairable by the local authority. If the flooding is due simply to the failure of the council to provide sufficient sewers, the only remedy is to make a complaint to the Local Government Board under sec. 299 of the Public Health Act, 1875. See *Robinson* v. *Workington Corporation* (1897, 1 Q.B., 619), in which the facts were somewhat similar to those in the present case. But if the flooding is attributable to something actually done by the council, an action for damages could be maintained. See *Whitfield* v. *Bishop Auckland Urban District Council* (*Times*, November 22, 1897). In that case a sewer was badly constructed, having defective joints. The council partially repaired it, but did not open the whole of it, and water escaped from it and damaged the plaintiff's houses, and it was held that the council had been guilty of "misfeasance," and damages were awarded to the plaintiff.

COMBINED DRAINAGE.—"Vectis" writes: Properties marked A to E on attached plan drained into a stone culvert land in passage, as shown in double dotted line, from street to discharge into the river. The culvert had a "dead end" at the street, and did not take storm-water from the street. The culvert became choked and caused a nuisance, and upon testing was found to be defective. The local authority, without giving notice to the owners or occupiers, entered and constructed a new single drain, and connected it to



their main sewer in street, and connected up properties B to E with the new drain. The property A was allowed to remain connected with the stone culvert. (1) Can the local authority now recover cost of works from owners under sec. 47 of the Public Health Act, 1875, on the grounds that the stone culvert was an "unsealed cesspit"? (2) Was the stone culvert "a sewer," the Public Health Amendment Act, 1890, being in force? (3) Can local authority recover cost under any other section?

(1) No, I think not. (2) Yes, in my opinion. But, even assuming that it was a "single private drain," within the meaning of sec. 19 of the Act of 1890, that section would not apply, inasmuch as the houses were not connected by the culvert with a public sewer. (3) No, I think not.

HIGHWAY PROJECTING COVERS.—"Projecting Covers" writes: I shall be glad of your opinion on the following: The local authority as the water authority have laid water mains in streets which have been laid out by private enterprise, but have not yet been taken over by the local authority. Certain covers to valves and hydrant boxes are projecting an inch or so above the surface of the roadway, owing to the wearing away of the gravel around such covers or

through the sinking of the road surfaces, or possibly from a combination of both causes. The covers are in good condition, and are as originally put down. Is the local authority, as the water authority, liable to keep the covers at the level of the road surface by raising or lowering them from time to time, or are the owners of the roadway liable to keep the road surface level with the covers? Would your opinion be the same in the case of manhole covers on sewers not taken over by the local authority?

In my opinion, assuming that the covers to the valve and hydrant boxes were properly constructed, and are not out of repair, the local authority are not liable, as water authority, to raise or lower them from time to time, to keep them level with the road surface; nor, upon the like assumption, are they liable, as sewer authority, with respect to the manhole covers. I would point out, however, that (with the exceptions mentioned in sec. 13 of the Public Health Act, 1875), *all* sewers vest in, and are reparable by, the local authority, and manholes are part of a sewer. See *Swanston* v. *Twickenham Local Board* (1879, 11 Ch.D., 838). The owners of the soil of the roadway are not liable to keep the road surface level with covers of any description, unless they are liable to repair the road *ratione tenuræ*, in which case they are bound to keep the road, as dedicated, in such a state as to be safe for ordinary traffic.

Salary.—"Celery" writes: An official commenced his duties on October 1st, the agreement being that the salary should be paid quarterly. On December 25th (Christmas quarter) he was paid 86/365ths of the yearly salary, and on March 25th (Lady Day), June 24th (Midsummer), and September 29th (Michaelmas) following he was paid a quarter of the annual salary. Was the first payment in order, or should it have been for only one day short of the quarter, the previous quarter day being September 29th?

In the absence of any stipulation to the contrary, I think the salary would be payable by four equal instalments at the expiration of three, six, nine, and twelve months respectively from the date on which it was agreed that the service should commence. If the service was to commence on October 1st, then, in the absence of any such stipulation, the first quarterly instalment would be payable on January 1st following; a fractional payment of less than one-fourth of the year's salary would not be in order.

Ownership of Trees on Road Wastes.—"H. G." writes: I should be very much obliged if you would kindly let me know to whom the trees on road wastes belong. Is it the lord of the manor?

As a general rule trees on road wastes belong to the owner of the soil (who will usually be the owner of the adjoining land). See *Turner* v. *Ringwood Highway Board* (L.R., 9 Eq., 418). Wastes adjoining main roads vest in the county council, under sec. 11 (6) of the Local Government Act, 1888, if they are actually part of the highway, but not otherwise. See *Curtis* v. *Kesteven County Council* (45 Ch.D., 504).

THE OUTLOOK FOR BRITISH ENGINEERS IN CANADA.

Engineering News, of New York, after quoting in its issue of September 28th our "Minute" of August 25th on the above subject, comments as follows:—

It may be well to warn British engineers not to look to Canada as a field for employment; but the reasons might have been more accurately stated. Although some of the cities in Western Canada went too fast and far in municipal expenditure, and particularly in real estate booming before the war, and while all of them have been sacrificing men and money and curtailing municipal and other civil expenditures during the war, it is probable that Canadian municipalities as a whole will resume the construction of public improvements on a large scale soon after the war ends. By far the larger part of the engineering work involved will naturally and properly be done by Canadian engineers. These men are destined to harvest most of the plums—and the lemons also. A few consulting engagements will doubtless come to engineers in the United States, but our British contemporary is far afield in its supposition that all the best engagements and large fees go across the international boundary. What is more natural than that engineers of Canada and of the United States should be given preference over those of Great Britain, when the first are on the spot where the work is to be done; the second are next at hand, while the third are a long ocean journey away? As to it being "generally held that American methods and ideas are best suited for Canada," this is so obviously in accord with the facts as to leave no need whatever that the "belief" should be "sedulously fostered by interested Americans."

It will be seen that our contemporary confirms our main statement, though it differs on minor issues as to the why and wherefore.

ROAD MAINTENANCE IN WAR-TIME.

A COUNTY COUNCIL'S APPEALS.

Appeals by the Somerset County Council for men engaged on main road work occupied the attention of the Somerset Appeal Tribunal at Taunton on Saturday. The council sought conditional exemption for George Forward Norris (27), married, divisional road surveyor in the Long Ashton division; William George Perry (26), single, of Barrow Gurney, foreman of a steam rolling gang; and Oliver Flook (31), married, of Nailsea, road foreman, all passed for general service.

Mr. F. W. Bishop, of Bridgwater, for the council, said the Long Ashton division was the only one in the county where the roads were kept in repair by direct labour under the council. Of all the district surveyors Norris was the only one the military had endeavoured to take, all others who required it having been granted conditional exemption. Conditional exemption had, in fact, been granted Norris by the Weston-super-Mare local tribunal, but had since been withdrawn on the application of the military representative. Traffic in the Long Ashton division was exceedingly heavy, and the expenditure on road maintenance—£196 per mile—was the highest in Somerset. Much work was being done in conjunction with the Road Board, and it would take twelve months to finish what the council had undertaken to do. They could not possibly do without a divisional surveyor.

Mr. Folland, acting county surveyor for Mr. Stead, who is on service in France, stated that of the ordinary staff of eight in the office he was the only one left, and he had been medically rejected. Mr. Norris was a fully qualified and very competent road surveyor.

Colonel Kirkwood, chairman of the County Works Committee, supported the appeals. He said he had served forty years in the Royal Engineers, and was the military representative at one of the Bath tribunals. The roads in the Long Ashton division had to be entirely reconstructed to bear the heavy traffic from Bristol. He considered that Norris was doing better national service by continuing his road work than he could do as a private in the Army.

Mr. Marshall (military representative to the Weston Tribunal): Is it not a question of wages? There must be men over 41, practically retired, who would be willing to take on this work.

Colonel Kirkwood: They are all busy. I am a great deal over 70, and yet I am as busy as I can be. If you offered me £1,000 or £10,000 a year, I could not take on any more work.

After consultation, the chairman (Judge Lindley) said the cases were difficult ones, because they must maintain the roads. With regard to Norris, they could not help saying that it was important to get a man of his age into the Army, if it were possible to do so without detriment to the national interests. They did not think it would be easy to replace him, but the difficulty of finding a substitute might be got over if the salary were made higher. They proposed therefore to exempt him for three months, to give the county council an opportunity for making further efforts to find a substitute. Flook would be exempted to December 28th, and no other application to be made for him without special leave. The appeal for Perry was adjourned for a fortnight, to see if a substitute named Williams, whose application was coming before the local tribunal, secured exemption.

During the hearing of the appeals Colonel Kirkwood said he had received a letter from the Road Board asking him to confer with the county surveyor, and bring him up to London for a conference, with a view to remaking the roads to meet the extraordinary traffic expected as soon as the war was over.

The War and Contracts.—At the last meeting of the St. Thomas Rural District Council an opinion was expressed by Mr. Harris, a councillor, that the penalty under which road contracts were entered into should be enforced in those cases in which the certificates were withheld. The surveyor, Mr. J. Bray, pointed out that under present conditions the contractors were unable to get the material. Mr. Harris thought the war was being made to answer for a lot of sins. He was an employer of labour and managed to fulfil his contracts. The surveyor was requested to bring up a report on the matter.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Barking U.D.C.—Preliminary sketch plans for the proposed new library baths were approved generally and ordered to be forwarded to the Carnegie trustees.

Batley T.C.—A committee has been instructed to go into the question of the provision of premises for use as a disinfecting station. The Watch Committee recommend that the borough surveyor, Mr. O. J. Kirby, should prepare a report on the condition of the public baths.

Brighton T.C.—The Health Committee recommend the construction of two dining rooms at the sanatorium, at an estimated cost of £250.

Cardiganshire C.C.—Damage which was estimated at £50 having been caused to Brithdir Bridge, Rhydlewas, by a traction engine, the surveyors were instructed to examine all bridges with the view of placing warning notices upon them.

Erith U.D.C.—It is proposed to construct a shelter for tramway passengers in Walnut-road.

Grimsby T.C.—A tuberculosis dispensary and children's clinic is to be built at the municipal hall, at an estimated cost of £840.

Jarrow T.C.—Plans are being prepared for a children's cleansing station.

Luton T.C.—The Electricity Committee propose to convert the test-room at the electricity works into an office, and to provide a temporary test-room at a cost of £200.

Maidstone T.C.—At a meeting of the Education Committee, Mr. Egerton Martin raised the question whether there was a sufficiency of fire extinguishing appliances in the elementary schools, and on his suggestion the matter was referred to the School Management Sub-Committee.

Newton Abbot U.D.C.—The choice of a site for a proposed slaughter-house has been referred to the Sanitary Committee.

HOUSING AND TOWN PLANNING.

Lanarkshire C.C.—Attention was drawn at the Middle Ward District Committee's meeting to the scarcity of workmen's dwellings in the district, and it was stated that the matter would receive the attention of the Housing Committee.

MOTOR TRANSPORT.

Aberdeen T.C.—A sub-committee have been asked to consider the purchase of an electric coal-tipping wagon for the electricity works.

Dewsbury T.C.—The corporation are recommended to purchase a motor vehicle for haulage purposes.

Golcar U.D.C.—Inquiry is being made as to the price of a steam motor wagon.

Leeds T.C.—The corporation has decided to add to its fire brigade motor equipment, and has accepted the tender of Messrs. Merryweather & Sons, of London, for the supply of a petrol-motor fire engine, fitted with "Hatfield" reciprocating pump. The full pumping power of the engine will be 400 gallons per minute, but a 30-gallon water-tank will also be provided, from which the pump can draw a supply immediately on reaching the scene of outbreak, so as to throw a small jet for "first-aid" work. Arrangements will also be made to carry a fire escape already in the brigade's possession, and ample accommodation will be provided for firemen, hose, and gear. The type of engine selected is a great favourite with Yorkshire brigades, having been adopted by Doncaster, Huddersfield, Middlesbrough, Harrogate, Shipley, Malton, Stanley, Ossett, Ripon, Selby, among other towns.

London C.C.—The offer of Leyland Motors (1914), Limited, has been accepted for the supply of two motor fire engines at the price of £907 each.

Margate T.C.—Subject to a loan being sanctioned for the purpose, it has been agreed to purchase a motor fire engine, at a cost of £1,165.

Pudsey T.C.—A decision has been reached to purchase a motor fire-engine and appliances.

Stoke-on-Trent T.C.—The town council have approved the recommendation of the Watch Committee to purchase a motor fire-engine.

PARKS AND OPEN SPACES.

Morpeth T.C.—The Countess of Carlisle has made the gift of a public park to the town council.

Newton Abbot U.D.C.—It has been agreed to expend £50 upon the improvement of the bowling green.

ROADS AND MATERIALS.

Brighton T.C.—The Works Committee recommend repairs to the surface of the roadway in a portion of Queen's-road.

Croydon T.C.—It has been agreed to carry out repairs to the tramway track in part of Selhurst-road, and also to double the line, at an estimated cost of £2,156.

Darlington R.D.C.—With reference to grit spreading, the surveyor, Mr. W. J. Pallister, stated that the main roads were done by hand, which was a slow process, but the county council had refused to bring the gritting machines. The clerk, Mr. C. H. Leach, said they asked the county council if they might purchase gritting machines from them for use on the main roads, and they said they were not prepared to sanction it, as if they took the roads into their own hands they would need the machines. The council instructed the surveyor to interview the acting county surveyor and endeavour to come to an arrangement for the use of the machines on the main roads.

Hull T.C.—The Works Committee have agreed to purchase for £315 a strip of land from Pickering Park for the purpose of widening Pickering-road. Under an arrangement with Mr. Pickering, one-half of the purchase money will be spent in the provision of a pavilion, bandstand, and greenhouse in the park, and the other half will be added to the endowment fund of the Pickering almshouses near the park gate.

Middleton T.C.—It is proposed to pave part of Manchester New-road, at an estimated cost of £575.

Northants C.C.—The county surveyor, Mr. C. S. Morris, has been authorised to execute road works at Weedon barracks for the military authorities, at an estimated cost of £695.

North Riding C.C.—The Highways and Bridges Committee reported that damage estimated at £2,500 had been caused on a portion of the Thirsk and Ripon main road by military traffic. The Road Board had offered £500 towards the repairs, and the county council agreed to accept this sum.

Shepshed U.D.C.—The surveyor, Mr. J. G. Foston, has been instructed to get a sample of "Presto White" and try it on the kerbs for the dark nights.

Tamworth T.C.—Subject to the sanction of the Local Government Board, it is proposed to negotiate for the purchase of the necessary land for the continuation of Cross-street to Upper Gungate, and make up the street.

SEWERAGE AND SEWAGE DISPOSAL.

Camborne U.D.C.—It is proposed to provide £400 in the estimates for sewer extension works.

Castlerea R.D.C.—It was complained that since the Congested Districts Board had acquired certain properties in Ballinlough the sewerage had been neglected, and the council have made an order upon the board to carry out the necessary works.

Lancaster R.D.C.—Pending a larger scheme of improvement of the sewer outlet at Glasson Dock, the surveyor, Mr. W. Dixon, has been instructed to prepare a scheme of temporary alterations to prevent the tide backing up the sewer.

WATER, GAS, AND ELECTRICITY.

Barrow T.C.—It is the intention of the corporation to promote a Bill next session to enable them to take more water from their Duddon River supply. The Duddon waterworks were opened in 1910, and the corporation had sought powers to tap the river to the extent of 5,000,000 gallons per day. This was strenuously fought by mining and iron-smelting com-

panies, and local authorities, and riparian owners, with the result that the allowance was made 2,000,000 gallons, except under certain circumstances. Since then the demands of Barrow's greater population, and the enormous amount used at Messrs. Vickers, and other works, has caused a serious shortage of water. Now the corporation desire to secure a bigger supply from the Duddon, and are to ask Parliament for the necessary powers.

Bideford U.D.C.—A sub-committee having reported on the water supply, the council agreed to open communications with the Local Government Board on the subject.

Birmingham T.C.—The Electricity Supply Committee recommend that the Local Government Board be asked to sanction a loan of £6,830 for plant and works at the Vachells generating station.

Chelmsford T.C.—The town council on Monday last decided to acquire by agreement the undertaking of the Chelmsford Gas Company for £86,056, which is equal to £104 for every £100 of the company's stock. The corporation take possession on January 1st next, but the purchase money will not be paid until a year after the end of the war.

Keighley T.C.—The Electricity Committee recommend the town council to lay an extra high-tension cable in Cavendish-street.

Llandudno U.D.C.—A sulphate of ammonia plant is to be installed at the gasworks, at an estimated cost of £500.

Luddenden Foot U.D.C.—An intimation has been received that the Yorkshire Electric Power Company propose to apply for authority for a lighting order in the district.

Middlesex C.C.—Further discussion as to paying Sir John Snell's account for £696 for expert advice and report in relation to the electricity supply for the Metropolitan area resulted in opposition being withdrawn. Several speakers expressed the view that Sir John's report was of the highest value with a view to future possibilities, and Alderman Bigwood said he knew that the London County Council had paid ten times as much for similar expert advice.

Redruth U.D.C.—Complaint was made by members that the council were paying the Urban Electric Supply Company £374 a year for lighting and getting very little light. It was argued by a member, however, that they had been very liberally treated by the company, as they had been let off a sum they were legally bound to pay. The Lighting Committee were instructed to see what could be done.

Stockton T.C.—It is proposed to carry out extension works at the gasworks, at an estimated cost of £1,770.

Wimbledon T.C.—The Board of Trade are being asked to sanction a scheme for the supply of electrical energy to Cuddington.

MISCELLANEOUS.

Ayr T.C.—It was reported that the revenue of the tramways for the past financial year was £19,285, an increase of £1,300. The result of the year's working was a deficit of £16, which was paid out of the reserve fund, which now stands at £4,632. There are thirty-two women in the service, and twenty of them have been trained as drivers.

Lindsey C.C.—The council at their meeting recently passed a resolution unanimously in favour of the adoption of the decimal system.

Warwickshire C.C.—The council have adopted a recommendation of the Roads and Bridges Committee to grant a war bonus of 3s. per week to each of the inspectors (all of whom are married men) and 1s. per week for each child under fourteen. The committee also made reference to the increased travelling expenses of the inspectors who at present pay these expenses out of their salaries—and in view of the higher cost of petrol and horse-keep recommended the payment of £10 per annum to each of the inspectors towards their travelling expenses, which the council also agreed to.

County Officials' Petrol Allowances.—The executive council have decided to give their support to the following resolution received from the Somerset County Council: "That the County Councils Association be requested to impress upon the Local Government Board and the Petrol Control Committee the extreme importance of immediately increasing the petrol allowance to county officials constantly travelling over the county in order to enable them to perform their duties efficiently."

MUNICIPAL SCHEMES AFTER THE WAR.

Chelmsford T.C.—The town council have decided that the following works, which are needed, and which might be undertaken by the council at the conclusion of the war, be included in the return to the Local Government Board: Wood paving in Wood-street; Galleywood-road widening; Lady-lane and Sandford-road widenings; laying tar-macadam in certain roads; provision of a refuse destructor; extension of the sewerage scheme of the borough; and the erection of new engine-house at Admirals Park waterworks.

Chertsey R.D.C.—The schedule of work submitted by the surveyor, Mr. H. Beaney, includes sewerage undertakings at Byfleet and Pyrford, the former estimated to cost £4,380 and the latter £4,810.

Dartford U.D.C.—There is a proposal to build 150 houses, provided the scheme can be made self-supporting, and various local improvements are suggested.

East Ham T.C.—A new wharf and plant, estimated to cost £2,000; tanks and extra beds at the sewage works, £9,600; hospital extension, £15,000; sewerage, £10,500; surface-water drainage, £800; and artisans' dwellings, £50,000.

Finchley U.D.C.—Schemes involving an estimated expenditure of £230,000 are proposed, including the provision of workmen's dwellings, an open-air swimming bath, a refuse destructor, and an elementary school.

Harrow U.D.C.—Public street improvements, private street works, and new machinery for the pumping station.

Howden R.D.C.—The water supply scheme is the chief work that the council had in contemplation before the outbreak of hostilities, and borings for water were carried out at Newbald. Further progress with the scheme was discontinued until after the war. The scheme therefore stands over. According to an estimate made some time ago the scheme would cost over £50,000.

Shepshed U.D.C.—The question of scheduling a scheme for the erection of eight houses on the land purchased at Oakley-road has been adjourned for further discussion.

Withernsea U.D.C.—The council discussed the Local Government Board's circular recently, and it was generally agreed that some definite scheme of general improvements should be prepared.

Worthing T.C.—In addition to the proposed works mentioned last week, the Highways Committee recommend private street works in Marine-parade and Grand-avenue, estimated to cost £7,000; reconstruction of defective footways, £2,000; and extension of water mains to couple up dead ends, £1,000. The Sanitary Committee propose (in addition to further public lavatory accommodation) the provision of further slipper baths and proper laundry accommodation at the baths, Turkish and vapour baths, £1,500; a suitable building for destroying horses, £500; new mortuary, £650; workmen's dwellings, £15,000. The General Purposes Committee recommend new groynes, at an estimated cost of £1,800.

Wrexham T.C.—It is proposed, as soon as practicable after the war, to proceed with the enlargement of the vegetable market, at a probable cost of £6,000.

MR. H. P. MAYBURY.

STAFF APPOINTMENT IN FRANCE.

Mr. H. P. Maybury, M.Inst.C.E., manager and engineer of the Road Board, has been "lent" to the military authorities in France, and will serve on the staff of Sir Eric Geddes, Inspector-General of Transport, in the position of deputy director of light railways and roads. Mr. Maybury is at present in London, following a fortnight's stay in France, but expects to return there in the course of a few days. During his absence Mr. J. S. Killick, Assoc.M.Inst.C.E., will act as his deputy.

Middlesex's New Guildhall.—At last week's meeting of the Middlesex County Council it was reported that the total cost of rebuilding the Guildhall, exclusive of the cost of the land, was £117,204.

PERSONAL.

Mr. Sidney Palmer, borough surveyor of St. Ives, Cornwall, has been granted an increase of 5 per cent on his salary.

Colonel Hunter, who has been on service for some time, has resigned his position as sanitary inspector to the Maldens and Coombe Urban District Council.

Mr. T. B. Simmons, engineer and sanitary inspector to the Wigton Rural District Council, has been appointed surveyor and inspector to the Keswick Urban District Council.

Mr. J. H. Drew, formerly engineer and surveyor to the Wath-upon-Dearne Urban District Council, has been presented with an eight-day mahogany clock by the officials and workmen, upon his appointment as borough engineer and surveyor of Grantham.

Mr. S. C. Chapman, water engineer to the Torquay Town Council, has tendered his resignation as vice-president of the Institution of Water Engineers. In a letter of regret at this decision the council express warm appreciation of the services he has rendered to the institution.

Captain McElduff, of the Northumberland Fusiliers, has been awarded the Military Cross. He is twenty-three years of age, and served his articles in the office of Mr. J. B. Renton, surveyor to the Whickham Urban District Council. He was assistant surveyor to the council when he enlisted in November, 1914.

Mr. C. J. Haller, county surveyor of Nottinghamshire, has been commended in high terms by the Highways Committee of the county council for his services to the county. Mr. Haller has been engaged on important work for the War Office, and it was intimated at the meeting of the council on Tuesday that a substantial recognition of his services was being made by the Government.

FOR OTHER ADVERTISEMENTS

See End of Paper.

COUNTY BOROUGH OF WIGAN.

TEMPORARY ASSISTANT.

The Corporation of Wigan invite applications for the appointment of a Temporary Assistant in the Borough Surveyor's Office, at a salary of £130 per annum.

Applicants must be neat and expeditious Draughtsmen, accurate Surveyors, Levellers, and must be ineligible for military service.

Preference will be given to candidates having had experience in Housing and Town Planning.

Form of application may be obtained from Mr. A. T. Gooseman, Borough Engineer and Surveyor, King-street West, Wigan.

Applications, stating age and experience, accompanied by copies of not more than three recent testimonials, and endorsed "Temporary Assistant," must be sent to me not later than Wednesday, the 15th inst.

WILLIAM HENRY TYRER,
Town Clerk.

Town Clerk's Office,
Wigan. (3,155)

COUNTY OF WEST SUFFOLK.

Assistant to County Surveyor required immediately, to fill temporarily the place of one called up for military service. Candidates must be experienced in Road Construction, the Keeping of Accounts, and Office Routine, and preference will be given to those who are good Draughtsmen, and have a knowledge of Bridge Construction.

Applications, in the candidate's own handwriting, stating age, qualifications, experience, and salary required, with copies of three recent testimonials, to be received by the undersigned not later than 10 a.m. on Monday, 13th November, 1916.

W. LIONEL JENKINS, ASSOC.M.INST.C.E.,
County Surveyor.

Shire Hall,
Bury St. Edmunds.
November 1, 1916 (3,153)

SURVEYOR'S ASSISTANT, salary £40 per annum and board with Surveyor. Applications to be sent as early as possible to

E. H. PADFIELD,
Surveyor, Wells Rural District Council,
Westholme,
Pilton,
Shepton Mallet (3,154)

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Brighton T.C. (October 27th. Mr. R. E. Maxwell).—This was an inquiry into the application of the corporation for a Provisional Order to amend their Acts of 1903 and 1912 so that they can lease the right of user and of running any motor omnibuses, and to extend by five years the period limited by the Act of 1912 for the completion of the trackless trolley vehicle equipment.—The town clerk, Mr. Hugo Talbot, stated that when the corporation obtained their trackless trolley powers in 1912 the Act fixed five years as the period within which the system was to be constructed and completed; and that in the same year the Hove Corporation obtained corresponding powers in their Act. The main route was to extend from the eastern boundary of Brighton to the western boundary of Hove, this embracing the main avenue of traffic in the two towns, and the scheme of the Act of 1912 was that the two corporations should construct routes on a system to be agreed between them, each corporation to have running powers over the other's area. The two corporations negotiated as to the system, but while Hove favoured the over-running equipment, Brighton preferred under-running, and as they could not agree they were approaching the period when it seemed necessary to resort to the arbitration provided in the Act to determine the question. Approximately at that moment the war broke out, and everything was at once suspended and an agreement entered into between the two corporations which provided that the period for the construction and completion of the overhead equipment should be further extended until the expiration of two years after the declaration of peace. And it was by mutual agreement that the present application for the extension of the period of construction of five years was made. The Act gave the Brighton Corporation power to lease their trackless trolley, but not their motor-'bus powers, and it was thought by the council that it would be convenient to have it. They wanted the Act amended accordingly, and this formed the second part of their present application. Confirmatory evidence of the town clerk's statement having been given by Alderman Wilson, J.P., the inquiry was closed.

Bristol T.C. (October 25th. Mr. R. C. Maxwell).—£9,386 for the purchase of property in Kingsland-road and Oxford-road, St. Philip's, for the purpose of a playground.—It was stated that property comprising ninety-two houses, and eight ground rents of the annual value of £57 had been acquired. The total area was 6,289 sq. yds. The purchase money was £7,335; interest on purchase money, £975; tenants' compensation, £200; vendors' and purchasers' legal charges, £491; purchasing agent's commission, £215; out-of-pocket expenses, £277; solicitor's legal charges for conveyance, £42; stamp duty, £73. An exchange was proposed by which the corporation would get a balance of £226 from the railway company, so that the amount applied for would be reduced by that amount, making it £8,928. Whatever might be thought of the regularity or irregularity of the method of procedure, the city council came to the conclusion that Mr. Pope (chairman of the Housing Committee) who had arranged for the purchase, had been actuated by the best motives in adopting the action he took, and that he had in reality made a very good bargain for the corporation. It was a scheme for getting rid of unhealthy buildings, and for providing an open space and dwellings, and there was statutory authority for acquiring it. The city engineer, Mr. L. S. Mackenzie, was present at the inquiry.

APPLICATION FOR LOAN.

Lewisham B.C.—£1,378 for road widenings and improvements.

LOANS SANCTIONED.

Porthcawl U.D.C. £949 for sewerage works.

Bury T.C. £600 for an electric cable.

FORTHCOMING INQUIRIES.

NOVEMBER.

		£
7.	**Chatham.** For a scheme of internal sewerage (Mr. A. G. Drury) .. .	—
7.	**Rochester (held at Chatham).** For a scheme of internal sewerage (Mr. A. G. Drury)	—

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Does not the eleventh annual meeting of the National Association of Local Government Officers, to be held at Caxton Hall to-morrow, promise to be somewhat interesting when the question of the present financial position of the association is discussed? Is it not evident from the last issue of the *Municipal Officer* that the finances of this association require very serious consideration, and that either some very drastic curtailment of the expenses or a substantial increase in its revenue will be necessary?

* * * *

Does it not seem rather curious that while there is so much talk of every penny being wanted for war purposes there should be so many strong advocates for an enormous expenditure in the reconstruction of Charing Cross railway bridge and the station? Do we not find also that the Westminster City Council have agreed to contribute £13,333 towards the cost of the Grosvenor-road embankment scheme, which is estimated to cost £80,000, and that the Middlesex County Council are engaged in the construction of the Great West Road? While agreeing that these improvements are greatly needed, would it not be better that they should stand over until we win this war; and is it not evident that before such a consummation is reached this country will be burdened with a heavy debt which will have to be paid somehow?

* * * *

Are not the citizens of Oldham setting a very good, patriotic example by engaging in whitening the kerbs opposite their premises, and thus saving the ratepayers' pockets? Do not little actions of this sort show that some people, at all events, are willing to help in some way, and that if there could be some better organisation of civilian assistance throughout the country it would go a long way to shorten the duration of the war?

* * * *

Did not Councillor Allan, of Edinburgh, make out quite a good case in the *Scotsman* recently in favour of tramways as against motor 'buses for Princes-street when he calculated that to carry the passengers there would have to be a fleet of motor 'buses running every fifteen seconds, and pictured what this would mean by imagining such a string of 'buses "passing and repassing each other all over the street, running to the side to let down passengers and then jostling for position again"? But could not a good deal, on the other side, be said about the noise of tramcars and their obstruction to the general traffic with a thirty seconds' service?

* * * *

Does it not seem essential that something should be done to erect more houses for the working classes in Newcastle-on-Tyne when we find by the last annual report of Dr. Kerr, the medical officer of health, that there are in that city only 150 unoccupied dwellings, of which sixty are uninhabitable, and that 28 per cent of the inhabitants live in single-room dwellings? As the population of Newcastle-on-Tyne is now, approximately, nearly 300,000, does it not seem time that steps should speedily be taken to remedy this state of affairs?

* * * *

Is it a fact that the authorities in Berlin now levy a tax of 40s. a year on everybody who keeps one dog in that city, and 80s. per dog for each one over and above the one dog? Why is it that something of the same sort cannot be done in London, where, in some districts, the footpaths are in such a disgraceful state?

* * * *

Is not the Leake, Notts, Rural District Council to be congratulated that they have been able to secure the services of a surveyor and sanitary inspector for their district at the modest salary of £52 per annum? Is it not about time that a trades union or some similar "self-protecting" association should be formed to secure a living wage for surveyors in view of the largely increased cost of food and other commodities?

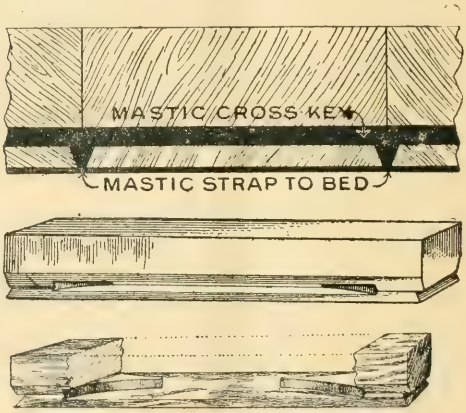
* * * *

Does it not savour of rather peculiar finance when we read that the Dublin Corporation are borrowing money of an American firm of financiers to the extent of £400,000 at 5 per cent for ten years, in connection with the scheme for "rebuilding" Dublin? And, according to The Surveyor of October 20th, the corporation propose to loan money to owners, for rebuilding, for sixty years, but at what interest is not stated, though we may assume that it cannot be more than 5 per cent. How is this difference of terms to be met, and will the ratepayers have to put their hands in their pockets to meet the liability?

KEYED WOOD BLOCK FLOORING.

In the system of wood-block flooring known as "Bennett's Patent Damp-proof and Double-keyed," instead of the usual groove there is a slot cut right through the blocks, commencing about 2 in. from each end. This slot forms a box in the lower part of the blocks, the ends of which remain solid. The blocks instead of being dipped are gently swirled in the boiling mastic, which results in the solution flowing right through the cavity and overflowing on to the bed on both sides.

As the result of this process there is formed one coat of mastic under the block and another on the bottom of the cavity (which overflows and joins up with the bed or bottom mastic), while a third coat covers the top of the cavity. There are thus three coats of mastic between the bed and the wearing part of the block. The method not only straps each block to the bed, but keys each block firmly to the other. The whole base of the block is bedded in the damp-proof and antiseptic solutions, and the actual wearing



part of the block is completely isolated. Among the advantages of the system are the following:—

(1) Blocks can be taken up at any part of a floor and at any place and in any quantity, and replaced without breaking the key or system, as by swirling the new blocks in the boiling solution they can be put in again and the key perfectly remade. This cannot, we understand, be done with any other keying system.

(2) Nothing is taken away from the wearing surface.

(3) The main requirement for a satisfactory wood-block floor is a perfect and permanent anchorage to the bed.

(4) The absorption of dampness from the bed and the attacks of dry rot are absolutely prevented.

(5) The common excuse put forward for bad floors—viz., a damp bed—is ineffective in the case of Bennett's patent, as the floor can be laid as soon as the bed is hard enough, and whether still damp or not.

The manufacturers of the system are the "Zeta" Wood Flooring (Stratford) Company, of Jupp-road, Stratford.

Timber, Plywood, and Woodwork.—In next week's issue there will appear a page advertisement which will give various particulars of timber, plywood, and woodwork which Messrs. C. Jennings & Co. have for sale. The page will be found useful for reference by all who make use of such goods. The firm's head office is at Pennywell-road, Bristol, but they have branches at Leicester, Porthcawl, and stocks warehoused at Swansea, Hull, Pembroke Dock, Neyland, Newcastle, Manchester, Liverpool, and elsewhere.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City, No. 1046) subject to later confirmation by letter.*

PLUMBER AND WATER-WASTE INSPECTOR.—November 4th.—St. Ives Town Council, Cornwall.—Mr. S. Pellow, surveyor, Council Offices.

BOOK-KEEPER AND CLERK.—November 8th.—Gillingham Town Council. £2 2s. per week.—Mr. Alex. Beasley, borough surveyor and water engineer, Municipal Offices, Gillingham.

SURVEYOR.—November 8th.—Commissioners of Sewers for the Western Division of the Lordship of Ely.—Mr. P. Allen, Clerk of Sewers, Ely, Cambs.

GASWORKS MANAGER.—November 9th.—Pyrford Urban District Council. £110 per annum with house.—Mr. R. A. Cooper, clerk, Council Offices.

SURVEYOR OF SEWERS.—November 10th.—Commissioners of Sewers for the County of Lincoln. £250 per annum.—Mr. G. Beaumont Wicker, clerk of Sewers, Clerk's Office, Spilsby.

TEMPORARY ASSISTANT SANITARY INSPECTOR.—November 13th.—Maidstone Rural District Council. £2 per week.—Mr. Thos. A. Bacon, surveyor and inspector, Council Offices, King-street, Maidstone.

SHORTHAND TYPIST (Male or Female).—November 14th.—Barking Town Urban District Council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

ENGINEERING ASSISTANT.—November 14th.—Barking Town Urban District Council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

MAIN ROAD DISTRICT SURVEYOR.—November 16th.—Derbyshire County Council. £230 per annum.—Mr. J. W. Hobson, county surveyor, County Offices, Derby.

ROLLER DRIVERS.—November 20th.—Hendon Urban District Council. £2 2s. per week.—The Surveyor, Council Offices, Hendon, N.W.

FOREMAN PLUMBER.—Sheffield Corporation Waterworks.—Mr. Wilfrid Terry, general manager, Town Hall, Sheffield.

ROAD AND GENERAL FOREMAN.—Beaconsfield Rural District Council. 36s. per week.—Mr. E. Picker, surveyor.

ASSISTANT ELECTRICAL ENGINEERS.—For the Government of India.—Age between twenty-three and forty. 280–320 rupees per month.—Director-General of Stores, India Office, Whitehall, S.W.

TEMPORARY ASSISTANT SURVEYOR.—Whiston (Lancs) Rural District Council.—Mr. R. J. Knapman, surveyor and sanitary engineer, Council Offices, Whiston, Prescot, Lancs.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

SHEFFIELD.—November 7th.—For the erection of a fitter's shop, for the Electric Supply Committee.—The Offices, Commercial-street, Sheffield.

BELFAST.—November 20th.—For building an open-air school at Whiteabbey, for the corporation.—City Surveyor, City Hall, Belfast.

Engineering: Iron and Steel.

NEWPORT (Mon.).—November 6th.—For the supply of petrol converters and switch gear, for the corporation.—Mr. A. Nichols Moore, borough electrical engineer, Town Hall, Newport (Mon.).

DORSET.—November 6th.—For repairing and widening the Creekmore Bridge, for the county council.—County Offices, Dorchester.

BRAY.—November 7th.—For a second-hand travelling steam crane, 4 tons, for the urban district council.—Town Clerk, Town Hall, Bray, co. Wicklow.

MANCHESTER.—November 8th.—For the supply of valves for steel and water pipe lengths, etc., for the low-pressure steam and feed pipes, and supports and alterations to existing pipework, and the supply of one hydraulic wagon tipper, for the Electricity Committee.—Mr. F. E. Hughes, Electricity Department, Town Hall, Manchester.

MANCHESTER.—November 14th.—For the supply and erection of a steam disinfector, for the Tramways Committee.—Mr. J. M. McElroy, general manager, Corporation Tramways, 46 Piccadilly, Manchester.

WALLASEY.—November 21st.—For the supply and erection of 25 per cent liquor concentrating plant and connections at the gasworks, for the corporation.—The Gas Engineer, Lunehdu-lane, Seacombe, Wallasey.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St. Dunstan's-hill, London, E.C.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Ryetell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

Roads.

TILBURY.—November 6th.—For the supply of 300 cub. yds. of good binding road gravel, for the urban district council.—Mr. S. A. Hill-Willis, engineer and surveyor, Council Offices, Tilbury.

MADRID.—November 7th.—For the construction and maintenance of granite pavements.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

LAMBETH.—November 9th.—For the supply of 4,000 sup. yds. of grey Yorkshire stone paving flags from Yorkshire or Lancashire, for the borough council.—Mr. H. Edwards, borough engineer, Town Hall.

MEATH.—November 10th.—Wanted to hire, two large steam traction engines to drive stone crushers, for the county council.—County Surveyor, County Hall, Navan, co. Meath.

CLEETHORPES.—November 11th.—For the supply of 1,000 tons of granite for the urban district council.—Mr. L. W. Pye, acting surveyor, Cleethorpes, Lincs.

CARSHALTON.—November 21st.—For the supply of 275 cub. yds. of 1½-in. granite, either Clee Hill, Quenast, Penmaenmawr, or Guernsey, and the hire of steam road roller and scarifier, for the urban district council.—Mr. W. Willis Gale, surveyor, District Council Offices, The Square, Carshalton.

WEST HARTLEPOOL.—November 22nd.—For the supply of Yorkshire and concrete kerbstone, flags, scoriæ and whinstone channel blocks and paving setts, hand, machine, and unbroken whinstone, pitch, tar, and lime, for the corporation.—Mr. N. F. Dennis, borough engineer and surveyor, Town Hall.

WARWICKSHIRE.—November 24th.—For the supply of road material (broken and unbroken), and tarred macadam, for the county council.—Mr. John Willmot, county surveyor, 6 Waterloo-street, Birmingham.

Sanitary.

HORSHAM.—November 4th.—For the supply of clinker to the sewage farm, for the rural district council.—Mr. F. F. Haddock, clerk, 9 Carfax, Horsham.

BLEAN.—November 6th.—For emptying cesspools, earth pails, and removing house refuse, for the rural district council.—Mr. R. Miles, sanitary inspector, Eddington, near Herne Bay.

EGHAM.—November 6th.—For laying a 1-ft. 6-in. surface-water drain, for the urban district council.—Mr. A. G. Hutchins, clerk, Council Offices, Egham, Surrey.

GIBRALTAR.—November 14th–21st.—For the supply of galvanised iron pipes, lead pipes, Welsh or Stourbridge firebricks and fireclay, English shaped stock bricks, intercepting traps and kitchen sinks, and glazed sanitary pipes and half-pipes, for the Sanitary Commissioners.—Sanitary Commissioners' Office, Gibraltar.

Stores.

BRADFORD.—November 11th.—For the supply of materials for the tramways department, for the corporation.—Tramways Offices, 7 Half Edge, Bradford.

BRISTOL.—November 13th. For the supply of cement, drain pipes, castings, ironmongery, paints, brushes, bass brooms, and motor rotary brushes (refilling), for the corporation. City Engineer 63 Queen-square, Bristol.

CHATHAM. November 15th.—For the supply of Aylesford gravel, sand Thames ballast, crushed ragstone, Portland cement, sewer boots, stoneware drain pipes, sewer ironwork, disinfectants, brooms, brushes, picks, shovels, and ironmongery, for the corporation. Borough Surveyor, Town Hall.

Miscellaneous.

DALTON-IN-FURNESS.—November 18th.—For the supply of about 1,000 Staffordshire tile grave indicators, for the urban district council.—Mr. W. Richardson, surveyor, Town Hall, Dalton-in-Furness.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BARKING.—Provisionally accepted for the repair and painting of a bascule bridge, for the urban district council.—Mr. R. A. Lay, acting surveyor.
Sanders & Forster, Barking, £1,067.

EGREMONT.—For the supply of 500 yds. of 4-in. galvanised steam-strength water pipes, and cutting trench, for the urban district council.—Mr. J. Cowan, surveyor:—
J. Whittle & Son, Whitehaven.
A. A. McArd & Co., Whitehaven.
W. H. Holloway, Whitehaven.
J. Russell & Co., Walsall.
J. Russell & Sons, Wednesbury.
E. Nicholson, Moor Row.
Heathcote & Son, Cleator Moor.
J. Woodburn, Egremont.
J. Dawson, Whitehaven.
† J. B. Hodgson, Frizington.

WAKEFIELD.—For channelling and sewering works, for the corporation.—Mr. J. P. Wakeford, city surveyor:—
W. Brigg, Eccleshill, Bradford.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

6. Society of Engineers: Mr. C. T. A. Hanssen, Assoc.M.Inst.C.E., on "Heating and Ventilating Private Dwelling Houses." Caxton Hall, Westminster, 5.30 p.m.
7. Institution of Civil Engineers: Address by the president, presentation of medals, 5.30 p.m.
7. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
9. Institution of Sanitary Engineers: Sir John McCall, Agent-General for Tasmania, on "The War for Health." Caxton Hall, Westminster, 5.30 p.m.
10. Town Planning Institute: Mr. T. Alwyn Lloyd on "Town Planning in Wales, with Special Reference in Development of Hilly Sites."
13. Surveyors' Institution: President's opening address. 5 p.m.
14. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
21. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
28. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

DECEMBER.

5. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
8. Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.
12. Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

APPOINTMENTS OPEN.

DERBYSHIRE COUNTY COUNCIL.
MAIN ROAD DISTRICT SURVEYOR.

Wanted, at once, for the period of the war, Temporary District Surveyor, ineligible for military service, to take charge of Main Roads in a district under direct maintenance.

Salary at the rate of £230 per annum, to include provision and maintenance of motor bicycle. An additional allowance of £10 per annum will be made for provision of office.

Particulars of duties, &c., and Form of Application can be obtained from the undersigned, to whom applications must be sent on the special Form not later than Thursday, the 16th November.

J. W. HORTON,
County Surveyor.

County Offices, Derby.
October 31, 1916. (3,151)

BARKING TOWN URBAN DISTRICT COUNCIL.
SURVEYOR'S DEPARTMENT.

The above Council requires, for a period of about twelve months, the services of—

(*a*) A Qualified Engineering Assistant;
(*b*) A Shorthand Typist (male or female).

Candidates for the former appointment should have been trained in the office of a municipal engineer, be neat and expeditious draughtsmen, and ineligible for his Majesty's Forces.

Forms of application for both appointments may be obtained from Mr. R. A. Lay, Assoc.M.Inst.C.E., Acting Surveyor to the Council, Public Offices, Barking, and should be duly completed and returned to the undersigned not later than Tuesday, the 14th proximo.

(By order),
E. A. PRATT,
Acting Clerk to the Council.

Public Offices,
Barking.
October 25, 1916. (3,147)

SURVEYOR OF SEWERS WANTED.
WAPENTAKES OF CALCEWORTH, CANDLESHOE AND HILL, AND SOKE OF BOLINGBROKE, AND PART OF THE WAPENTAKE OF LOUTH ESKE.

His Majesty's Commissioners of Sewers for the County of Lincoln require the services of a General Surveyor of the Sea Banks, Gowts, Culverts, Rivers, Banks, Drains, and other Works and Defences of Sewers within the said Wapentakes and Soke.

The Surveyor will be required to reside within the district, and to devote the whole of his time to the duties of the office.

The salary will be £250 per annum.

The general duties may be ascertained on application to the undersigned.

Applications, with testimonials, must be delivered at my Office in Spilsby on or before the 11th November next, endorsed "Surveyor of Sewers."

(By order)
G. BEAUMONT WALKER,
Clerk of Sewers.

Clerk of Sewers' Office,
Spilsby.
October 24, 1916. (3,140)

MAIDSTONE RURAL DISTRICT COUNCIL.
TEMPORARY ASSISTANT SANITARY INSPECTOR.

The above Council require a Temporary Assistant Sanitary Inspector (ineligible). Salary £2 per week, inclusive. Applications, stating age, experience in Sanitary, Housing and Town Planning inspections and qualifications, accompanied by copies of not more than three testimonials, to be sent to the undersigned on or before November 13th, and from whom further particulars may be obtained.

THOS. A. BUSBRIDGE,
Surveyor and Sanitary Inspector.

Council Offices,
King-street, Maidstone.
November 1, 1916. (3,150)

TEMPORARY ENGINEERING ASSISTANT

Wanted for a Borough Engineer's Office in Yorkshire. Candidates must have had previous experience of the usual work and routine of a Municipal Office, and must be ineligible for military service. Applicants must state age, experience, and salary required.—Apply Box No. 1,594, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (3,152)

SHEFFIELD CORPORATION WATER-WORKS.
FOREMAN PLUMBER.

Wanted, a qualified and experienced Waterworks Plumber to superintend the work of the Plumbing Department.

Applicants must have held similar position, be accustomed to control workmen, and ineligible for Military Service.

Apply by letter, stating age, experience, and wages required.

WILLIAM TERREY,
General Manager.

Town Hall,
Sheffield.
October 26, 1916. (3,142)

ROAD MAKING.

REINFORCE CONCRETE ROADS WITH
EXPANDED METAL.

EXMOUTH SEA DEFENCE WORKS. Expanded Steel Concrete Slope and Roadway. Length 1 mile; total width of Roadway, 65 feet.
Mr. SAMUEL HUTTON, Urban District Council Engineer and Surveyor

THE EXPANDED METAL COMPANY, LIMITED
(Patentees and Manufacturers of Expanded Metal).
Head Office: YORK MANSION, YORK STREET, WESTMINSTER, LONDON, S.W.
Works: STRANTON WORKS, WEST HARTLEPOOL.

DRAIN AND TUBE CLEARING MACHINES

Supplied complete with specially selected **MALACCA CANES**, fitted with ordinary Brass Interchangeable Joints.

Also with the **"FERRET"** or other patent **LOCKFAST JOINTS.**

Cannot Slip the Thread or Unscrew
Interchangeable Self-locking

Contractors to H.M. Government, Principal Railway Companies, Borough Councils, and Municipalities throughout the World.
IN USE BY EMINENT SANITARY EXPERTS EVERYWHERE.

We are specialists in **DRAIN CLEANING and TESTING APPLIANCES.** *Catalogue on application.*

CAKEBREAD, ROBEY & CO., Caroba Works, **WOOD GREEN, LONDON, N.**
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VICTORITE TREAD

As used in THEATRES, SCHOOLS, HOSPITALS, ASYLUMS, and other PUBLIC BUILDINGS. (Regd.)
It is the most EFFECTIVE TREAD, and gives an ABSOLUTELY SURE FOOTHOLD.

The great advantage of this TREAD is that the material, which prevents the possibility of slipping, is brought over the nosing of the step. It is here where most treads fail. Is bright and clean in appearance, of great durability, and inexpensive.

Full Particulars and Prices on application. Specialists in Architectural Stone Dressings, Staircase Work & Granolithic Paving (in situ).

THE PATENT VICTORIA STONE COMPANY, LIMITED, 11-13 HAMILTON HOUSE, BISHOPSGATE, LONDON, E.C.
Telegraphic Address: "Victoria Stone, London." *Telephone Nos.: 2866 London Wall.*
Established 1868. Works: STRATFORD MARKET, ESSEX, and GROBY, NEAR LEICESTER.

ROAD AND GENERAL FOREMAN, over military age; good cyclist. Beverley Rural District Council. 36s. per week. Testimonials, &c., to E. Picker, Surveyor. (3.143)

TENDERS WANTED.

CARSHALTON URBAN DISTRICT COUNCIL.

GRANITE AND STEAM ROLLING.

Tenders are invited as follows:—

(1) For the Supply of 275 cub. yds. of 1½-in. Granite, either Clee Hill, Quenast, Penmaenmawr, or Guernsey, delivered at Mitcham, Hackbridge, Sutton, and Wallington Stations as required before the 31st March, 1917.

(2) For Hire of a Steam Road Roller and Scarifier, fitted with an approved patent attachment for watering the wheels and the road, of not less weight than 10 tons, and for a 6-ton Steam Roller, with watering attachment, for a period of about thirty days as may be required, during the year ending 29th October, 1917.

Particulars in each case may be obtained on application to the Council's Surveyor, Mr. W. Willis Gale, ASSOC.M.INST.C.E., at this Office.

Sealed Tenders, addressed to the Chairman, and endorsed "Tender for ....." should be delivered at this Office not later than 12 noon on Tuesday, 21st November, 1916.

The Council do not bind themselves to accept the lowest or any Tender, and the persons whose Tenders are accepted will be required to enter into the usual Contract and Bond, which may be seen at this Office.

(By order),

C. P. LOVELOCK,
Clerk.

District Council Offices,
The Square, Carshalton.
November 1, 1916. (3.148)

DALTON-IN-FURNESS URBAN DISTRICT COUNCIL.

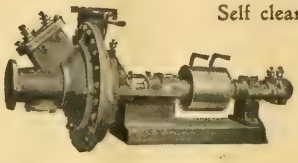
The Burial Board Committee invite Tenders before the 18th November for the Supply of about 1,000 Staffordshire Tile Grave Indicators.

Application for particulars and sketch of the Tile to be made to

W. RICHARDSON,
Surveyor,
Town Hall,
Dalton-in-Furness. (3.144)

Stereophagus Pumps

Self clearing.



For Lifting Unscreened Sewage.

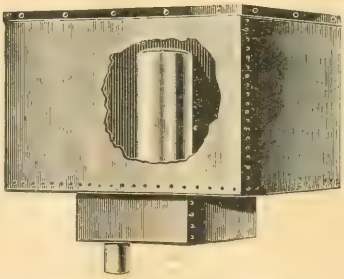
WRITE FOR LIST No. 712.

Pulsometer Engineering Co. Ltd.

Offices:— 11 Tothill Street, London, S.W.
Works:— Nine Elms Ironworks, Reading.

BRABY'S AUTOMATIC FLUSHING TANKS.

SIMPLE.



RELIABLE.

Illustrated Price List on application.

FREDK. BRABY & CO. Ltd., 352 to 364 EUSTON RD., N.W. IDA WORKS, DEPTFORD, S.E.

Security £6,349,479

LONDON & LANCASHIRE FIRE INSURANCE COMPANY LTD

FIRE.
Consequential Loss.
ACCIDENTS.
BURGLARY. MOTOR CARS
EMPLOYERS' LIABILITY.
MARINE.
Insurance against BOILER EXPLOSION and ENGINE BREAKDOWN.

Head Offices { 45 DALE STREET, LIVERPOOL. 155 LEADENHALL STREET, E.C.

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of every description, including Pumps, Hose, Water Lifters, Jointing for Pipes, Valves, Specialities as illustrated, and Road-roller Stores . . . .

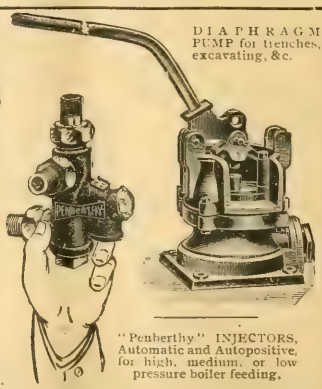
for Borough Engineers and Surveyors.

We can supply YOUR requirements promptly and at reasonable prices. . Write, 'phone, wire or call. A copy of our 736 pp. CATALOGUE will be gladly sent upon receipt of application on business form.

W. H. WILLCOX & Co., Ltd.
32-38 Southwark Street, London, S.E.

"Penberthy" Automatic CELLAR DRAINER for removing "flood" troubles.

DIAPHRAGM PUMP for trenches, excavating, &c.



"Penberthy" INJECTORS, Automatic and Autopositive, for high, medium, or low pressure boiler feeding.

The Surveyor

And Municipal and County Engineer.

Vol. L. NOVEMBER 10, 1916. No. 1,295.

Minutes of Proceedings.

The Institution of Civil Engineers' Presidential Address.

Municipal engineers may congratulate themselves that the new president of the Institution of Civil Engineers, Sir Maurice Fitzmaurice, has a direct connection with their branch of the profession by reason of his former tenure of office as engineer to the London County Council. In taking as the main subject of his presidential address the various causes of lack of success in engineering work, Sir Maurice adopted a rather novel line, but one which is nevertheless fully justified. The engineer necessarily gains much of his knowledge from experience, and the study of failures is in this connection of the greatest importance. One general cause is undoubtedly to be found in unwise financial restriction. Sir Maurice holds that engineers are as a rule too optimistic in designing their work, and in their estimates of cost and time. Be this as it may, the fact remains that even in works where all the details have been worked out with the greatest care, where unit prices have been carefully scrutinised, where the different stages of the work have been well thought out, where all possible local information has been obtained, it is usual to provide a sum of money over and above the detailed estimate to meet any contingencies which may arise, and to make some addition to the estimated time for construction. Apart, however, from questions of estimating, there are certain well-defined usual causes of trouble in engineering work. The first one is the small knowledge the engineer is able to obtain of the conditions which exist below the surface of the earth, on which everything has to be founded; secondly, the risk which it is necessary to undertake as regards conditions of weather while works are being carried out; and, thirdly, the varying quality of many of the materials have to be dealt with. There is a fourth matter, which affects contractors more than engineers—namely, the difficulty of estimating the cost of materials and rates of wages for a long time ahead, although this also substantially affects engineers' estimates when there is a long interval between the time when the estimates are made and that when tenders are received. All these are varying factors in engineering work which cannot be accurately forecasted, and it is because of these and similar matters that it must be acknowledged that, although much of the work of an engineer is based on strictly scientific procedure, it is to a great extent dependent on experiment, experience, and a proper appreciation of the inexact knowledge obtainable.

Sir Maurice Fitzmaurice also made some interesting remarks as to the importance of research work. As we have pointed out on more than one occasion, this country is far behind America on this question. There it seems to be recognised that time and money spent on very full investigation and preliminary studies are well invested. The recently instituted Government scheme should do much to place matters on a sounder footing. The scheme in its main features is one conceived on broad and patriotic lines, which may lead to results even greater than were anticipated by those who framed it. The detailed arrangements under which it will be administered have not as yet been definitely laid down. Some, but not all, of the industries which may expect help are at the present time so engaged with war work that it is not possible for those controlling them fully to consider, much less to carry out, useful research work. Such work, to be of real value, must be undertaken in consultation with the different industries. It is, however, important that some definite lines for the working of the Government scheme should be laid down at an early date. It is to be hoped that it may be developed on such broad, liberal and generous lines as will command general confidence. If worked on such lines the scheme will be of great value. The concluding words of the address were directed particularly to the younger members of the institution, and contained some sound advice as to training and early experience. But, as was pointed out, experience and the passing of hard engineering examinations are not the only requisites for success as an engineer. Probably there is no class of engineer more in request than the resident engineer or assistant engineer with experience, who can "get on" with people. Engineers are afraid of assistants who can't get on with people. Such men irritate clients; they cause trouble whether they are on the engineer's or contractor's side. The capacity of getting on with people and still holding one's own has a distinct money value, and a very high one. These remarks might well be taken to heart by old and young alike.

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Electricity Supply in Dublin.

A remarkable state of affairs in connection with the electricity undertaking of the Corporation of Dublin has been revealed by the report of a special committee which was issued last week. The committee was appointed by the council in April last year to inquire into the administration and conduct of the undertaking, and in August, 1915, appointed Mr. P. W. d'Alton, M.INST.C.E., to make a thorough investigation. Mr. d'Alton's report was received in December, and parts of it were unofficially communicated to the local Press in February, together with extracts from counter-reports prepared by four of the officials concerned, giving rise to a good deal of comment and discussion. The whole of the reports have now been published *in extenso*, with a supplementary report prepared by Mr. d'Alton at the request of the special committee.

It appears from these documents that the history of the undertaking has been marked by a series of mistakes and misfortunes constituting a record unique among the annals of municipal electricity supply, with the result that the business

has failed to achieve the success that might fairly have been anticipated, and is being carried on under highly inefficient conditions. Passing over the early difficulties which the undertaking experienced in common with others of its kind, a fundamental error was committed in 1899, when the reorganisation of the whole system of supply was taken in hand. On the advice of the late Mr. Robert Hammond, a three-phase system of supply and distribution was adopted, to which Mr. d'Alton takes no exception, but unfortunately the corporation insisted on the adoption of a site for the generating station at the Pigeon-House Fort, which is situated at the end of a narrow peninsula jutting out into the sea, and necessitated the laying of long trunk mains between the station and the city. Moreover, the new station was laid out on far too small a scale, the engines originally installed were of faulty design and gave rise to endless trouble and expense, and a generating set which was added in 1906 also proved unsatisfactory. It then became necessary, in view of the growing demand, to commence a new station, as the old one could not possibly be extended. Modern turbo-electric generators were installed, but, owing to technical difficulties, the two stations could not for some time be operated together on economical lines, and the condensing plant has for a long time been in a defective condition.

Turning to questions of management, Mr. d'Alton severely criticises the system of running the plant, which he regards as highly inefficient and wasteful of coal; he considers that the works are over-staffed, much of the plant is in need of thorough overhauling, and a large addition to the generating plant is urgently necessary. Control of the undertaking is divided between "an engineer who is not a manager and a secretary who in part manages," a system to which Mr. d'Alton takes the strongest exception. In his opinion the engineer alone should be responsible for the selection of his staff and the development and measurement of the output. The charges for energy for private lighting and power are unduly high, the cost of the secretarial department is excessive, the system of coal supply is defective (it has been in the hands of one firm of contractors for years), and the records of units generated are unreliable owing to the bad condition of the meters. In addition to these items it appears from the reports that the city council has repeatedly ignored the advice of its engineers, and even that of the Electricity Committee, a fact which goes far to mitigate the responsibility of the staff for the unfortunate condition in which the undertaking now finds itself. In his supplementary report Mr. d'Alton replies to the points raised by the officials, and reiterates his main conclusions as to the defects of management of the undertaking, and in the result the committee has decided to recommend the council to invite Mr. d'Alton to take entire charge of the undertaking for a period of three years. The proposal has not yet been dealt with by the council, but is exciting a good deal of discussion in Dublin, where the undertaking has been the subject of severe criticism for many years.

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Contracts and Day Work.

Elsewhere in these pages will be found an article in which the relative merits of the two systems—viz., contract work and day work—are discussed at some length. In considering this question one has to guard against a very natural tendency to think that because a certain practice is allowed by custom it is necessarily right. In the opinion of the author, far too much responsibility is thrown upon the contractor, and from the engineer's point of view there is much to be said in favour of an alteration. Although it is perfectly true that some men have made fortunes merely by organising work, throwing the responsibility for every part of the work upon the shoulders of various contractors, the true engineer must always regard the practice with the disgust which it deserves. For instance, a man of organising capacity, who is no true engineer, will carry out a water supply scheme by employing a firm of well-sinkers to obtain the water, by obtaining ready-made designs for reinforced-concrete reservoirs, by employing one of the best-makers of engines and pumps to deal with the lifting of the water, by employing a maker of filters to purify it, and so on. Obviously, in such a case the contractors are the true engineers. They take all the risk, they make the calculations, they provide the designs, and without them the engineer, or so-called, would be helpless. The true engineer deserves the credit and profit. However, the British public are not quite fools, and when engineers act in this way, shirking the responsibility for which they charge fees, they and their profession must inevitably suffer in the long run. Such men are no longer required.

There is undoubtedly much work which can be done better at day-work prices than by contract. The municipal engineer has to do a great deal of work in this manner, and there is no doubt that much of the best and most economical work is done in this way. Hence the municipal engineer, by taking greater responsibility, begins to hold a higher position than the consulting engineer who, if a change is not made, will certainly pass out of existence for the reasons stated above. The engineer's object is that work should be well done, that the best materials should be procured at the cheapest price, and that the best and at the same time the cheapest scheme should be designed and carried out. A system which enables the engineer to do an engineer's work, which does away with the almost inevitable acceptance of the lowest tender, which ensures that all work shall be properly paid for, and yet that there shall be no waste of money, is undoubtedly a good system, but it will be urged that this throws great responsibility on the engineer. Doubtless; but if he is really an engineer, and not inferior to the contractors who work under him, he will welcome such responsibility. There is plenty of work waiting for such men to do, and it is not too much to say that the prevailing practice of doing almost everything by contract work is largely due to the fact that engineers are often unwilling to accept the responsibilities outlined above. The whole subject is one of special interest at the present time, and will be even more so in the future, and we invite our readers to give their opinions as freely as possible in written communications, which we shall be glad to publish.

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The Timber Shortage.

In the course of his recent presidential address to the Sanitary Inspectors' Association, to which we referred last week, Sir James Crichton-Browne drew attention once more to the rapid denudation of growing trees which is now going on in this country. The seriousness of the present position can only fully be understood when it is remembered that before the recent abnormal fellings for war purposes, our percentage of land under forest to total area was the lowest of all European countries, with the single exception of Portugal. Some idea of the character and extent of these fellings may be gathered from a photograph which appears in the current issue of the *Royal Magazine* showing some of the results of the labours of the 224th Canadian Forestry Battalion, which has been busy in the Surrey woods cutting down trees to be used for war purposes. This is only a sample of what Sir James describes as the "arboreal havoc and desecration of beauty" that are going on all over the

country. We are told that by modern methods a tree can be cut and turned into boards in about ten minutes, but when we reflect on the time that must elapse before these trees can be replaced, we cannot shut our eyes to the influence which the depletion may exert on the health and happiness of our people. We have on former occasions dealt with the necessity for a national policy of afforestation to meet the economic situation caused by the increasing shortage of home-grown timber. But, as Sir James reminds us, this is by no means the only aspect of the question. To use his words, forests are of value not only through the produce they yield, but through the influence they exercise on climate, the regulation of moisture, the stability of the soil, and the beauty of the countryside. They help to regulate the water supply, produce a more sustained feeding of springs, and render the flow of rivers more continuous, thus reducing the danger of floods, which may damage not only property, but health, by the dampness they leave behind them. They reduce the velocity of air currents, and when judiciously placed protect adjoining territory from cold or dry winds, and afford shelter to cattle, game, and useful birds, and so contribute to food supply. It is indeed to be hoped that the economic argument reinforced by those just enumerated may speedily induce the Government to take speedy action to deal with a situation that has already become serious.

* * *

Armagh County Surveyor and the Rural Council.

The difficulties of municipal and county surveyors in general are more than sufficient to suggest that their life, like that of Gilbert's policeman, is not always a happy one, but it is hard to escape the conclusion that the experiences of these officials in Ireland are sometimes more than ordinarily trying. Why this should be it would not be easy to say, except upon the hypothesis that in the urban and rural districts of the sister isle local self-government is more or less in a state of transition from the old to the new, with the older conventions still exercising a too-powerful influence upon the minds of the representative authorities. An example of the peculiar conditions suggested by these remarks was supplied recently by the proceedings of the Lurgan Rural District Council. A member took occasion somewhat pointedly to remind the council that at a previous meeting a resolution had been passed recommending that a certain road contractor be paid for the stones he had put on the road during the previous four months. The chairman just as pointedly inquired if this had been done, whereupon the county surveyor, Mr. R. H. Dorman, answered in the negative, adding that he would not pay for stones which were not in accordance with specification. The stones, it appeared, had been taken from a prohibited quarry, but in order to settle the matter the county surveyor—confessing that he thought he was not doing right in making such a proposition—had offered to pay a few pence less per ton. Mr. Dorman's apprehension was obviously not ill-founded, for his offer of a compromise was received with suggestions from councillors that he should "divide the difference," "yield a little," "allow a little more," and so forth. The novelty of the position is manifest when we remember that here were councillors pleading with a county official to pay a road contractor money from the rates in excess of the amount to which he was entitled. Mr. Dorman at length flatly declined to accede to their blandishments, saying that it was an attempt to bargain by the rural council that should not have been made. It is characteristic of the whole of this anomalous proceeding that the chairman, in defiance of actualities, "denied that there was any bargaining." At the same time the county surveyor was warned that it would be for the council "to keep their eyes open in future," which was evidently quite needless, seeing that the council were already sufficiently wide-awake to the possibilities of the situation.

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Health and Housing.

Among the most striking papers read at the recent Cardiff conference of the Sanitary Inspectors' Association was that by Bailie Stewart, of Glasgow, on "Health and Housing." The city from which Bailie Stewart hails is probably faced with a more serious housing problem than any other city in Great Britain. When it is realised that literally the greater part of the whole population of Glasgow are housed in one or two roomed tenements, it is difficult to dissent from the conclusion that the resulting effect on the public health is both disastrous and costly. Some measure of the devastation that is being wrought is afforded by the fact that the city is paying in round figures an annual sum of £750,000 sterling in dealing with ill-health and its effects. Bailie Stewart's theme was that housing reform lies at the root of all health improvement, and that until the people are decently housed campaigns against such scourges as infant mortality and tuberculosis are foredoomed to failure. The latter part of his address raised a very serious economic question. He contended that local authorities cannot build satisfactory houses for the working classes and make them pay, and he proposed as a remedy the virtual abolition of interest. His actual proposal was that the State should lend £30,000,000 per annum, free of interest, for some years to come, to local authorities to enable them to erect suitable houses, the authorities in their turn to charge such a rent as would pay the cost of maintenance and repay by a sinking fund the capital cost in sixty years. This is as bold a proposal as we have heard for dealing with the difficulty of the "economic rent." It is all to the good that the housing question is provoking discussion at so many meetings and conferences just now. Public opinion is, we believe, riper for a bold policy on the part of the Government than it has ever been before.

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Tyre Widths and Road Wear.

In a recent issue our contributor of "Things One Would Like to Know" asked whether road surveyors in this country ought not to think themselves fortunate that they have to deal with motor-'bus traffic, and not that of "byle gharries"—a type of vehicle in use in India. He went on to inquire, What is a "byle gharrie"? and the "Note on Cart Wheels and Tyres," by Mr. T. Salkield, the municipal engineer of Delhi, which will be found in another column, is published as a direct result of this query. A perusal of the article, which contains the substance of a paper read by the author before the All-India Sanitary Congress, shows how serious is the damage caused to roads in that country by the narrow-tyred wheels of the springless vehicles which are commonly used there. We are not sure as to the precise relationship that exists between the "byle gharrie" and the Delhi "thela," which Mr. Salkield claims to be the Indian champion road destroyer, but we gather that in none of these springless Indian carts is any attempt made to reduce the friction of the wheel upon its axle, and consequently the weight to be overcome is much increased and the reaction between the road surface and the wheel tyres retarded. The power of these vehicles to demolish road surfaces is further increased by the use of very narrow tyres, and it certainly seems that the whole matter is one that must be dealt with by by-law if the roads are to be preserved in a reasonable state of repair.

Contract Work and Day Work.

By H. C. H. SHENTON.

As a result of the uncertain conditions produced by the war a considerable amount of work which, under normal conditions, would have had to be done by contract has been done by day work, and some engineers have therefore had unusual opportunities for observing the comparative merits of the two systems.

A contract is useful chiefly because it enables some one who does not know how much a certain piece of work will cost, or how long its execution will take, to have certain knowledge on these points. Therefore the layman who is responsible for an outlay of money upon a piece of work demands a contract and tender, because this is the only way in which he can protect himself. The same should not apply, however, to the engineer, who ought to be able to estimate the cost of the work as well as or better than the contractor. But such is the timidity of the average engineer that, although he may prepare an estimate, he will not hesitate to ask to have it confirmed by actual tenders, and will seldom dispute the matter if the tenders received are above or below his estimate.

It is largely owing to this timidity on the part of the engineer that the layman fails to attach due importance to his estimate, and is not greatly surprised if it proves to be apparently too high or too low. Further, the engineer, being able thus partly to drop his responsibility with regard to the estimate, is apt to give less attention to its preparation than does the contractor. Further, when a tender has been accepted, the engineer is not greatly interested if the cost of the work to the contractor is greater or less than the contractor anticipated. As long as the work is well done, and done within the specified time, it matters little to him whether the contractor is working economically or not. The result is that a great deal of detail work which ought to receive the attention of the engineer is left to the contractor, who may or may not be capable of dealing with it. If he is incompetent, as is very often the case with small contractors, he organises his men badly, is unnecessarily extravagant, purchases material at unnecessarily high prices, or obtains material of inferior quality, and suffers loss by its rejection, and ultimately loses money, and is behindhand in time.

It may be argued that a contractor has to accept a risk which the client and the engineer are unwilling to take. He must therefore safeguard himself; he must not only calculate upon receiving a reasonable profit, but must also allow a proper sum to cover risk. Assuming that the risk materialises, the contractor loses the sum he has allowed to cover it. If, however, it proves to be non-existent, he makes a larger profit. Certainly, the contractor hopes to make this profit, and as certainly the client has no wish to pay for a risk which does not exist. It is a gamble on the part of the contractor, and in the long run he is the winner, unless he fails, as he often does. It is clearly a case in which each party hopes to get something for nothing, with a strong probability that the contractor will score. The system is unsatisfactory. Clearly the client ought to pay for all work done, and ought not, under any circumstances, to be able to make an honest contractor do work at a loss. It is equally clear that the contractor ought not to be paid for work which he might have had to do under certain circumstances, but which, as a matter of fact, he has not had to do. The system is just as immoral as any other form of gambling, and ought not to be supported with public money.

ETHICAL CONSIDERATIONS.

It is well at this point to consider the ethical side of the question. Most men, and certainly most contractors, all things being equal, have no special desire to do wrong when it is equally easy to do right. The process of obtaining an unfair profit or payment is, moreover, worrying, risky, and unpleasant. There are, indeed, a few people mentally deficient who *prefer* crooked ways, but these are a negligible quantity, and are chiefly interesting to the police. On the other hand, when the average person has suffered unjust treatment, when he has been forced to carry out a losing contract, to do work which was entirely unexpected without payment, to supply material at a losing price, to waste good material on unnecessary work, or when, owing to a miscalculation, he finds that he is losing money, then, being human, he looks around for some means of recouping himself. All this is only too likely to happen on a contract. The contractor, with ruin staring him in the face, and believing that, morally at any rate, he has been cheated, uses his ability and knowledge to make good his losses by scamping the work; nor will the most experienced engineer and the best staff of assistants wholly prevent him from doing so. Work done under such conditions is always bad. Those who try to rob contractors invariably reap their reward.

An ignorant man, or one of mean and inferior intelligence, will generally suspect the contractor from the outset. To him a contractor is a man who lives by making an illicit profit. But this foolish opinion is also common among highly educated persons who, not being men of business, look upon all business men as rogues. They cherish the sincere belief that certain practices exist in business which, though they are to be condemned on moral grounds, are, nevertheless, essential. They are entirely ignorant of the fact that the best business men are those of the highest integrity, whose word is to be absolutely trusted, and who are scrupulously honest and honourable in all their dealings. There is a tradition that contractors will always overcharge if they have the chance to do so, and unless a man has considerable knowledge of business he generally has this belief.

Without claiming perfection of morals for the average contractor, who is generally a sorely tried person, it is fairly safe to give him the benefit of the doubt that if he is reasonably treated he has no special wish at the outset to charge more than a fair rate of profit on his work. If he is sure of making this he has no incentive to wrong doing. On the other hand, he often possesses the sporting instinct, and is not averse to a gamble; but that is no reason why the engineer should gratify this propensity at the expense of his client.

Work done by contract provides the facilities for a gamble on the part of the contractor, and it is generally heads he wins and tails you lose, unless—as is often the case—you, by your superior knowledge, foresee the difficulties which he does not; in which case the contractor is made to lose owing to his ignorance or folly. Of course, there is the intermediate case where the contractor makes exactly the profit which is his due; but are these cases of frequent occurrence?

Work done at day work and schedule prices provides no such opportunities for gambling, provided that the engineer knows his business. It can be easily checked, and it would puzzle the ordinary contractor to make an unfair profit on that if the engineer looks after the work properly. This fact is generally overlooked.

RELATIVE ADVANTAGES.

Is there, then, so great an advantage in contract work? It seems that the chief advantage to the engineer is that it saves him the trouble of checking the men's time, the cost of materials, and the methods of the work, that it relieves him of great responsibility, and generally leaves him to do the tally while the contractor has to do the engineering work. But, after all, is there not something very dissatisfying to a real engineer in all this? Is it really the duty of the engineer to shelve his responsibility in this manner, and is it not largely due to this shelving of responsibility that the engineer in private practice in these days cuts a poor figure beside the old engineers, who certainly accepted greater responsibility?

A man is paid for the work he does and for the responsibility which he is prepared to take. The contractor generally makes more money than the engineer because he is ready to take this responsibility and is capable of doing it.

Work done by administration at day work and schedule prices is much more interesting to the engineer. It enables him to use his faculties to the fullest advantage. The contractor runs no risk of loss, and the client runs no risk of an overcharge, and if the engineer is competent his estimate is no more likely to be exceeded than that of the contractor, and his client will not be any more likely to incur an unexpected expense than would be the case in contract work.

The acceptance of the lowest tender, and, in fact, inviting of tenders from all and sundry, leads to interior work, and not infrequently to the ruin of the contractor and to the prejudice of the reputation of the engineer.

This is not to advise that all work should be done by day work, and that contracts are not generally necessary or useful, but it is to suggest that a great deal of the work which is now done as contract work might be done far better and more economically by administration. This doubtless means greater trouble and responsibility for the engineer, and the engineer who is capable of doing better work for less money than his competitors will certainly, as soon as the fact is known, be able to obtain payment in proportion to the value and extent of his work.

ARCHITECTS AND SLUM AREAS.

THE DISGRACE OF SQUALOR AND UGLINESS.

In his presidential address at the opening meeting of the eighty-third session of the Royal Institute of British Architects on Monday, Mr. Ernest Newton, A.R.A., said that if the timely suggestion of the Ministry of Munitions that the public would do well to take advantage of the lull in building operations to get plans prepared now for future schemes were generally followed, architects would be hoped to tide over the present difficult period. It would be a disgrace to the nation if, after the war, it was content to let the workers, who were now the fighters, live in the drab and dreary districts which many people seemed to look upon as the inevitable type of area for an industrial population. In London alone there were square miles to destroy and replan. When once the citizens of London began to realise the disgrace of squalor and ugliness, the architect would come into his own again. Not only the outlying districts cried aloud for change: there was a glaring example in the centre of London; and, thanks mainly to the untiring energy of Sir Aston Webb and the London Society, we seemed within measurable distance of carrying out a great scheme for sweeping away Charing Cross railway bridge and replacing it with a fine road bridge worthy of the capital. It was a hopeful sign that Parliament was on the side of the improvers. Possibly the number of those who cared much for a beautiful city was small: but if the rest of the community could be brought to see that it paid to have a fine city, the financial difficulty would be overcome.

BEDFORDSHIRE PETROL MOTOR LORRY COSTS.

In his report for the year 1915-16, Mr. F. W. Smart, the county surveyor of Bedfordshire, includes a schedule—reproduced herewith—in which are set out the cost of working of three Commer petrol-motor lorries during the twelve months ended December last.

It will be noticed that the cost per hour has increased by 7d. and the cost per ton-mile by 1d., the former being accounted for by the general increase in cost of labour and spare parts, which were very difficult to obtain, and then at a greatly increased cost. The cost per ton-mile, Mr. Smart observes, will always vary, as the ruling factor is the length of the journey, and in consequence of haulage continuously through the winter up to a local camp for the military authorities being comparatively a short journey, this cost is higher than last year, but approximately the same as the previous year.

The fourth lorry ordered by the council in November, 1915, from Commercial Cars, Limited, had not been delivered when Mr. Smart's report was issued, and the county surveyor has been given to understand that there is no probability of delivery for some time yet. Steam wagons have been hired to a slightly larger extent than previously. Comparing the cost of the council's lorries with those of the hired ones per hour, the difference appears to be very slight, being only 1d. per hour, but for a true comparison the average tonnage of materials hauled must be taken into consideration, and the following is an analysis on this basis—viz., in 1,574 hours the hired lorries conveyed 1,896 tons at an average cost of 3s. 9d. per ton, and during the same number of hours the council's lorries conveyed 2,907 tons at an average cost of 2s. 6d. per ton.

SCHEDULE SHOWING DETAIL COSTS OF BEDFORDSHIRE'S PETROL MOTOR LORRIES, YEAR ENDED DECEMBER, 1915.

Number of lorry.	Working hours.					Mileage covered.	Number of loads carried.	Weight of loads carted.	Materials.										Total cost of labour, materials, tyres, spares, &c.	Depreciation of capital.	Total.	Cost per ton-mile.	Cost per working hour.
	Loading.	Outward journeys.	Unloading	Inward journeys.	Total.				Petrol.	Motor engine oil.	Gear oil.	Waste.	Cloths.	Common oil.	Paraffin oil.	Grease.	Carbide.	Tyres.					
								Tons. Cwts.	Gals.	Gals.	Gals.	lb.	lb.	Gals.	Gals.	lb.	lb.		£ s. d.	£ s. d.	£ s. d.	d.	d.
1	779	642	313	505	2,239	12,678	857	4,288 19	2,236	111	28	4	16	3	2	269	9	—	419 12 6	104 15 9	524 8 3	3·97	562
2	809	666	381	560	2,416	12,596	943	4,692 15	2,346	156	40	7	9	4	4	269	15	—	423 5 6	104 15 9	528 1 3	4·04	535
3	581	458	302	400	1,771	9,998	579	2,891 16	1,516	95	18	6	4	1	6	203	8	—	299 19 6	104 15 9	404 15 3	3·89	548
Total ...	2,169	1,796	996	1,465	6,426	35,272	2,379	11,868 10	6,098	362	86	19	29	8	14	741	32	7	1,142 17 6	314 7 3	1,457 4 9	3·97	544
¾-yr. 1914	1,734	1,804	719	1,665	5,982	38,424	2,072	10,548 3	6,528	359	77	15	47	5	21	218	29	9	948 8 7	243 14 0	1,192 2 7	2·93	475

Obstacles to Success in Engineering.

By SIR MAURICE FITZMAURICE, C.M.G., M.A., M.A.I., LL.D., President of the Institution of Civil Engineers.

[In the following address, delivered on Tuesday evening last, on the occasion of his installation as president of the Institution of Civil Engineers, Sir Maurice Fitzmaurice, whose engineering achievements have earned for him a world-wide reputation, deals with some of the reasons which at times prevent success in the profession to which he belongs.]

There are two kinds of want of success which I propose to consider that in connection with works and that in individuals. There is a third class which some of us have experienced—namely, want of success in undertakings owing to the financial arrangements coming to grief; but this class, although very disconcerting to engineers, is not so clearly allied to our profession as the two former.

I do not suppose there are any engineers in this room who have carried out undertakings of any extent who have not had, at some time or other, to lament failure or accident in connection with at least some part of their works. For many years I was fortunate enough to be engaged by some of those great engineers whose portraits we see surrounding us, and I cannot recollect any large undertaking which has not at times caused my chief considerable anxiety owing to accident on some portion of the works, or from alteration in design having to be made on account of unforeseen causes. Since I have been carrying out works on my own responsibility, I have found a similar state of affairs, and I believe all engineers have from time to time experiences of a like kind.

I am not now speaking of great calamities or disasters. . . . I am referring to those misfortunes which happen more or less on all works of engineering construction. Although very often not of great magnitude, they cause the engineer, the contractor and client great anxiety and disappointment. The engineer in the case of accident causing loss of life, even although it may be in connection with temporary works for which he is not directly responsible, feels it very keenly, and probably thinks he might have taken, or caused to be taken, some precautions which would have prevented it. Although even a serious accident on works may not entail any extra cost to the engineer's client, it may necessitate such an addition to the time of construction as will seriously dislocate arrangements made for the use of the works, and may in that way be a cause of serious financial loss.

The necessity for alteration of design, or part of design, owing to unforeseen difficulties, is generally a matter which causes much anxious thought and trouble to engineer and client. Unfortunately, alteration in design is generally accompanied by increased cost and time. In exceptional cases unforeseen difficulties may necessitate abandonment of the work.

The question arises, Are engineers, as a rule, too optimistic in designing their work and in their estimates of time and cost? This question, however, only deals partially with the class of failures I am considering, and before going further I want to clear the ground in connection with one important point.

CONTRACT DIFFICULTIES.

Works of any size are generally carried out by contract, and the contractor employed has a very important bearing on the question. Probably every engineer would like to choose as contractor for any work which he has to undertake that firm which has previously carried out similar work for himself, or for engineers he knows. This course is, however, one which cannot be adopted, except in a few special cases, owing to obvious reasons.

As is well known, there are two ways of obtaining contractors for works, either by open tender or by asking selected firms to tender. In the first case it is generally understood that it is quite allowable not to accept the lowest tender if the firm has not the necessary experience and standing. There are, however, very often considerable difficulties in rejecting low tenders of unsuitable firms, and explanations to clients are often difficult. I have had experience of a firm tendering for work approximating in value to one million sterling who had no experience of the class of work tendered for, but whose financial and other references were good. Fortunately the tender was passed over. Later on, when the same firm obtained a small contract for somewhat similar work, amounting to about £35,000, failure took place before the work was two-thirds completed. I only mention this as an example of some of the difficulties which arise in open tendering. It is often very difficult to judge of the financial position and the capabilities of a firm of which one personally has no knowledge. Sometimes those who are given as financial and general references seem to rather more than stretch a point in favour of the firm inquired about, or the answers given are so vague as to be useless.

It might be considered that all difficulties could be avoided by asking selected firms to tender, and in such cases it is generally understood that the lowest tender will be accepted. The procedure is, however, often not satisfactory. It frequently happens that the client wishes to include in the selected list the name of a firm who has carried out to his knowledge some work in a satisfactory way, although of quite a different character to that being dealt with at the time. This is often the cause of great trouble to client, engineer and contractor.

We all know contractors whom we would cheerfully accept without any question of reference, firms who at an early stage of the work recognise the necessity of a good staff and of providing all necessary plant, and who know that the initial cost thereby incurred is more than regained by the facilities obtained in carrying out the work and by the saving resulting from curtailment in time of construction. It is probably due to the well-deserved profits made by such contractors that other firms without the necessary capital or experience are frequently tempted to tender for work which they are not capable of carrying out with satisfaction to the engineer or his client, or with profit to themselves.

It must not, however, be assumed that I am favouring in all cases the employment of the large contractors. I have had considerable experience with contractors in quite a small way of business who carry out the smaller contracts entrusted to them in a thoroughly satisfactory way, especially when they have laid themselves out for only one or two classes of work, when the principal can give personal attention to the matter, and when they resist the temptation to embark on undertakings beyond their capacity. Some of my most pleasant experiences in engineering work have been with such firms.

I do not know any more unpleasant position, both for contractor and engineer, than when it is evident that a contract is being carried out at a loss. In such cases the contractor, on the one hand, may be forced to carry out the work in a slow and unsatisfactory way, and the engineer, on the other hand, feels that he cannot well press the contractor to spend more money on plant and staff.

I have very shortly mentioned these difficulties with contracts as they are a source of real trouble, but I think I ought at the same time to acknowledge the great help which engineers obtain from many contractors. I consider that one of the most pleasant features of our profession in this country is the friendly and helpful feeling which generally exists between engineers and contractors. This is only to be expected when we know that many contractors and a large number of their assistants are connected with this institution.

ARE ENGINEERS TOO OPTIMISTIC?

I now come back to the question whether engineers, as a rule, are too optimistic in designing their work, and in their estimates of cost and time. On full consideration of the matter I am inclined to think that we must sometimes plead guilty to this charge, although the optimistic view and under-estimates of cost and time are not always willingly arrived at. I do not know whether my experience on this point is the same as that of other engineers.

I am well aware that even in works where all the details have been worked out with the greatest care, where unit prices have been carefully scrutinised,

where the different [illegible] the work have been well [illegible] where [illegible] local information has been obtained, but even when it is necessary to provide a sum of money over and above the detailed estimate to meet any contingencies which may arise, and to make some allowance to the estimated time for construction. In such cases, when adopting this course, I have been met with the statement, particularly when dealing with some Government or municipal authorities, "Very nicely, if the design has been properly worked out, you require that large sum of money for contingencies, or." Surely you can cut something off the estimated time for construction." Or, "Don't you think the provision of money for contingencies and time for construction After some consideration of the matter, Well what it comes to is that if everything goes well the contingency money might be materially decreased and the time for construction shortened, and I would prefer that we took the risk of cutting both down." The engineer knows that to cut down in such a course is not wise, and that if things do not go right the conversation will probably be forgotten, but very reluctantly finds himself forced in some cases to reduce his estimate of money and time.

What are the reasons why engineers frequently find that their most carefully made estimates of both cost and time are exceeded? The principal reason is, I think, given by the hackneyed but true phrase which we often hear that engineering is not an exact science. We are continually finding out more about the forces of Nature, but as long as the world exists we shall not find out sufficient to enable us to make exact estimates of time and cost, and guarantee works against accidents.

What, shortly, are the principal matters which cause us trouble? The first one, in my opinion, is the small knowledge we are able to obtain of the conditions which exist below the surface of the earth, or, in other words, the ground to be founded; secondly, the risk which it is necessary to undertake as regards whether the works are being carried out; and, thirdly, the varying quality of many of the materials we have to deal with. There is a fourth matter, which affects contractors more than engineers namely, the difficulty of estimating the cost of materials and rates of wages for a long time ahead. This last also substantially affects engineers' estimates when there is a long interval between the time when the estimates are made and that when tenders are received.

BORINGS AND WHAT THEY TELL.

As regards the first of these matters, we, in most cases, try to obtain all the information possible about the nature of the ground we have to deal with by making borings. It is extremely necessary to remark that the information obtained from borings is not always reliable, particularly when the ground is of a variable character. It is true that, with certain classes of boring machines, particularly when in rock, we can obtain cores which give information of great value. In many cases, however, it is very difficult to form a just estimation of the ground when the material has to be broken up by the ordinary drill before being brought to the surface. After all information has been obtained by borings, the fact remains that all we have is a rough idea of the nature of the ground at the exact spot where the boring has been made. In many cases it may be 50 ft. north, south, east, or west, very different information is obtained. . . .

Such cases could be multiplied at will, and it is quite obvious that borings cannot be made at such close intervals as will disclose, as far as borings can, the nature of all the ground which has to be dealt with.

Then there is the important point that even if by boring the nature of the ground be disclosed, we obtain very little information as regards the quantity of water which may be met with, the dealing with which may be a very important item, both in the cost and time of the undertaking. . . . Another matter which it is very difficult to determine by borings is what effect the pressure of the ground may have on the works which it is proposed to construct, or what safe foundation pressures can be adopted. We have recently had an important discussion in this institution on earth pressure, and suggestions were made, after some experiments had been carried out, that the old formulæ for earth pressure might with advantage be revised. The experiments referred to were not on a large enough scale to enable any definite conclusion to be arrived at, but discussion showed that there were different views as to the best method of calculating the pressure of a soil material of a more or less uniform character. When there are real differences of opinion on theory, and when there may be considerable local variation in the character of the material to be dealt with, it is easy to imagine the difficulty of accurate appreciation of the strength required for underground works, when the only data afforded by borings arrive in a crushed-up state through a comparatively small tube. Long experience in such cases is the principal base to work from, but even then considerable latitude is left to the personal factor, or even to the imagination of the engineer. . . .

I might dilate at much greater length over the pitfalls open to engineers in connection with the want of knowledge of what is below the surface of the earth. . . . I have, however, probably dealt sufficiently with this point to show how far removed from an exact science are those works which have, in whole or in part, to be carried out below ground level.

THE WAR OF THE ELEMENTS.

There are other causes which prevent engineers from obtaining exact results, and the war of the elements is very real to them. Many an engineer who has been carrying out harbour works stands helpless and dismayed on his works when an exceptionally heavy storm comes at a specially critical stage of construction, and when the work of months may have vanished in a few hours. . . .

It is not, however, only unfinished works which suffer. We can probably all bring to mind finished works of the same class which have stood for years and have eventually been overcome by storms of exceptional fury. In some cases failures of such completed works are not due to any initial mistake in design, but are owing to the fact that the inevitable ravages of storms for many years have not been dealt with as they occur, and that in fact maintenance works have been conspicuous by their absence.

Of course, harbour works are not the only ones which have to lament the occurrence of exceptional storms during construction. They often cause considerable damage to incompleted steel work, such as bridges and roofs, and in fact they take their toll from time to time from all works. . . . In some countries, where exceptional cold is experienced, the after effects of continuous frosts have to be fully allowed for in engineering works, both in estimates of cost and time. . . .

There are other matters affecting not only the estimates of cost and time, but also the utility of engineering works, which are due to the impossibility of being able to arrive at exact conclusions on many points which arise. . . .

There is, again, the perennial question of the *actual* stresses occurring in masonry dams. Some time ago this question was fully debated before the institution, and many experiments in connection therewith on many materials, except masonry and concrete, have been made. We still, however, know very little more than that certain dams designed on certain definite lines have been successful and that others have failed.

We may, again, consider the question of the improvement of rivers, and the many intricate questions which arise in connection therewith. As one of the members of this institution has very wisely stated, it is necessary for one to live for years with a river before all its idiosyncrasies can be mastered. It is, no doubt, comparatively easy to come to a conclusion on some matters which may obviously require to be dealt with, but dealing with an important river as a whole on a large scale probably requires more experience, study, and careful survey of all the natural features than any other work which an engineer has to deal with. . . .

A cause of occasional failure in temporary works is due to the fact that engineers and contractors sometimes take deliberate and justifiable risks in connection with such works. . . . In many cases of temporary works where risks are taken deliberately, the cost of reconstructing such temporary works, should failure occur, might only be a small portion of the cost involved if the works were constructed in a more solid manner, and in such cases the risk is fully justified.

ENGINEERING NOT AN EXACT SCIENCE.

Perhaps I have said enough in this rather melancholy recital of some of the difficulties which engineers have to contend with, to show that the common saying that engineering is not an exact science hardly goes far enough to show how inexact a science it is.

C.*

Although much of the work of an engineer is based on strictly scientific procedure, it is to a great extent dependent on experiment, experience, and a proper appreciation and balancing of the inexact knowledge available.

It is, under these circumstances, hardly to be wondered at that estimates of cost and time of construction are not always accurate. Although it is not possible to draw any very close deductions from different tenders submitted by competent contractors for the same work, owing to the fact that one contractor may happen to have in his possession the necessary plant, may have some special facilities in a certain locality, or may have a particular reason for wishing to keep some of his staff together, still the great diversity in the amounts of tenders received from capable and experienced contractors, after making allowance for these matters, is only a very practical confirmation of the fact that exact estimates of time and cost are impossible.

The difficulties I have mentioned, and many others, are, however, the reason why our profession is such an extremely interesting one. New unforeseen difficulties turn up every day, and new methods are being continually found out for dealing with them. Engineering works, after all, have to be carried out, and engineers and contractors have to design and construct them to the best of their ability.

RESEARCH WORK.

It is difficult to make any suggestions to facilitate our work, but it has occurred to me on more than one occasion that our brother engineers on the other side of the Atlantic devote more time than we do to preliminary work and studies, particularly in the case of large undertakings. They appear in some cases to have taught their clients that time and money spent on very full investigation and preliminary studies give a very good return on the expenditure. The Governments of Canada and the United States are also not averse to collecting information about rainfall, river discharges and other matters, which information is at the disposal of those who wish to avail themselves of it. If we could prevail on our clients and on our Government to take similar views, they would also find that the money was not wasted. We are, however, as things stand, dependent to a great extent on experience and private investigation and experiment for the success of many of our works. We ought not, at the same time, to forget the great obligations which we engineers are frequently under to chemists, geologists, metallurgists, meteorologists and others, for the great help which they ungrudgingly give us.

I hope, however, that the Government "Scheme for the Organisation and Development of Scientific and Industrial Research," which has recently come into existence, and which has already made a grant to this institution for research work, may be a real help to engineers. The scheme in its main features is one conceived on broad and patriotic lines, which may lead to results even greater than were anticipated by those who framed it. As far as I know, the detailed arrangements under which it will be administered have not as yet been definitely laid down. Some, but not all, of the industries which may expect help are at the present time so engaged with war work that it is not possible for those controlling them to fully consider, much less to carry out, useful research work. Such work, to be of real value, must be undertaken in consultation with the different industries. It is, however, important that some definite lines for the working of the Government scheme should be laid down at an early date. I hope and believe that it may be developed on such broad, liberal and generous lines as will command general confidence. If worked on such lines the scheme will be of great value. "A great Empire and little minds go ill together." ... .

WANT OF SUCCESS IN INDIVIDUALS.

The time will come when we must settle down again to our every-day duties, and therefore I venture to say a few words on the question of want of success in individuals. All of us, no doubt, on many occasions during our lives have made mistakes which, with a little reflection, we might have avoided. We have often bought our experience dearly. We probably realise that in some cases there was very little margin between success and failure. In looking back, however, over the great number of engineers whom I have come across on works and in offices, I cannot bring to mind any case of a hard worker who has really failed. It is true that all of them have not arrived at commanding and independent positions, but then all men have not the ambition, or wish, or capacity, for such positions. The attainment of such a place might possibly mean failure for some of them, and they prefer to retain the confidence and respect of their employers in the secondary posts, and in doing so they probably have a less anxious and a happier life. I know of some engineers who have not attained to high positions, but who could be sent to take charge of works, with the knowledge that every stage of the work will be carefully and continuously inspected by them, and that if any difficulties arise they will recognise them, and at once report to their chief fully and clearly about them. Such men are invaluable. There are, however, also a great number of engineers who begin their professional work with the hope and determination of getting to the top rung of the ladder, or at all events making a good fight for it. . . .

I consider that there has been in recent years some improvement in general education, which tends to give capable boys the chance of taking up the profession of engineering when they have an inclination in that direction. Very much more, however, might be done in this connection. . . . While I need hardly say that I am extremely keen about a radical alteration in our teaching, so that scientific education may be kept all the time in the foreground, I do not wish to see young men growing up without what in an old-fashioned way would be called a good general education. We at this institution have been altering our examinations and practical requirements from time to time so as to raise the scientific standard required for students and associate-members, but we have not forgotten the value of a good general education. . . .

ADVICE TO YOUNG ENGINEERS.

I have frequently been asked by parents of budding engineers, and by young engineers themselves, for advice, and the remarks which I have to make on this subject are specially directed to the students and the very young members of the institution. The examinations by the institution, or the corresponding ones at the universities, which have now for some time been required before a young engineer can become an associate-member of the institution, are, of course, only the ground-work for the work to come later on. Nothing can take the place of experience and actual contact with difficulties. It is therefore necessary that an engineer should devote his time to getting all experience possible.

I remember being told many years ago, by a friend who had passed through the engineering school at Cambridge University, that he asked the professor of engineering at that time for some advice on what he should do. The answer he got was: "Try and get into some large shops, or on to some large works; if you can't get taken on as an assistant or improver, try and get taken on as an assistant timekeeper." There is something to be said for that advice.

I have on one or two occasions been asked by a young engineer whether, of two posts offered to him, he should take that of one among many assistants on a large work with a small salary, or that of resident engineer on a small unimportant work at a considerably higher salary. Without hesitation I recommended the former position. I knew that on the large works he would see a little of almost every class of work, that even the temporary works of the one were probably more important than the permanent work of the other, and that the fact of being on a large work would be of great assistance later on, and would stand to him all his life. He would also have the advantage of daily intercourse with other engineers, and the emulation and friendly rivalry between them would lead to efforts on his part to hold his own. There also exists on large works a feeling, which I can only describe as engineering atmosphere, which may have a real influence on the life of a young engineer.

THE WAYS TO SUCCESS.

Experience and the passing of hard engineering examinations are, however, not the only requisites for success in our profession. I suppose there is no class of engineer more in request than the resident engineer or assistant engineer with experience, who can "get on" with people. Engineers are afraid of assistants who can't get on with people. Such men irritate clients; they cause trouble whether they are on the engineer's or contractor's side. The capacity of getting on with people and still holding one's own has a distinct money value, and a very high one.

Closely akin to it is the one of being fair in dealing with questions which arise on works. The resident engineer and the contractor's engineer who are open with each other, and will not take any unfair

advantage of one and all, have both obtained a reputation of great value and which may have a far-reaching effect even on both their firms.

In my opinion there is nothing which so much enlarges a young engineer's breadth of view, and gives him a feeling of self-confidence, as a few years' work abroad. The ideal conditions in connection with this are that it should be after some years' work at home, and be on works under construction by a British firm; but these ideal conditions are not, of course, always possible. One can only acquire knowledge of how works are carried out abroad, and the differences between such works and those in this country, by actually being engaged on the details of construction. In going abroad, young engineers should be careful, if possible, not to break any engineering connection which may have been formed at home. I personally have always considered it was extremely fortunate that I was employed for seven years on undertakings outside this country. In view of foreign work, it is essential that a young engineer should know well at least one foreign language. This knowledge will often be the deciding factor in gaining an appointment.

All young engineers should take every opportunity of carrying out experimental work. Such opportunities occur on nearly every undertaking. It need not be original work, as that is not always possible, but even the repetition of work previously done gets one interested and accustomed to that class of work, and it may be the means of correcting and enlarging the work done by others. . . . Very frequently the engineer in charge of works or shops sees opportunity for carrying out experimental work with very little money expenditure, but frequently that small amount of money cannot be found. If there were a fund available from which grants could be made in such cases for certain definite experimental work, I consider it would be very valuable, both to the members as a body, and the member carrying out the investigation.

I think I have said enough to show young engineers that success depends on many matters besides knowledge of engineering, and that even with a moderate knowledge of engineering other qualities may be developed which command a high money value and are the means of attaining to important positions.

There now comes probably the most difficult question of all for a young engineer, the chance which makes him known, the opportunity by which he can show that his qualities have been under-valued. There are many curious ways in which this opportunity arises. He may work steadily for many years, and it may suddenly come in the most unexpected way, and it generally does come once if deserved. . . . I am not, however, going further into this question to-night, except to point out that I am not at all sure that young engineers realise the importance of attending the meetings, joining in the discussions, and contributing papers to this and other institutions. I don't think I have ever written a paper, or got out notes for a discussion, without discovering that there were several points on which my information was deficient in some particular, which otherwise I should not have known it was necessary to look further into. It is extremely difficult in many cases for even a very good young engineer to get himself known, and the reading of papers and joining in discussions is almost the only legitimate form of advertisement open to him.

My remarks are really reflections on the different events which have occurred during my own life as an engineer, extending now to over thirty years. I hope they at least show that there is still ample room for investigation and experimental work, which may enable us to give still greater value to our clients, and that it may influence young engineers especially to devote some of their time to that class of work whenever opportunity for doing so is present.

County Councils and Housing Loans.—At their last meeting the executive council of the County Councils Association referred to committee a letter from Hertfordshire County Council suggesting that the Local Government Board be asked (1) to introduce legislation making the period for the repayment of loans raised to defray the cost of cottages erected by county councils and other local authorities for their employees eighty years instead of thirty years as at present; and (2) to provide in the proposed legislation that the Public Works Loan Commissioners shall lend the necessary funds at the lowest rate of interest for the time being in force on loans made by the commissioners.

SEWAGE DISPOSAL IN STAFFORDSHIRE.

SATISFACTORY EFFLUENTS.

In his report covering the year 1915, Dr. George Reid makes an interesting reference to the duty which devolves upon him as medical officer of health of arranging for the systematic inspection of sewage disposal works operating in the county of Staffordshire.

As regards sewage effluents, while special attention is directed to recently constructed works, the works which have been thoroughly established are by no means overlooked. All are systematically inspected by the county river inspector, who at once reports any irregularities he observes. Needless to say, his visits are surprise ones, no previous notice being given of his intention to visit, and Dr. Reid thinks it speaks well for the good faith of the local authorities that his visits are hailed with appreciation rather than resentment.

It is customary to call the Public Health Committee's attention at the time to any serious irregularities which are noted in the management of sewage works, and the responsible authorities in such cases are invariably communicated with. Many lesser irregularities noted, however, are satisfactorily dealt with by Dr. Reid, without troubling the committee, by merely calling the local surveyor's attention to them.

As regards the southern districts which drain into the river Tame, Dr. Reid is glad to be able to state that the new and extensive works at Walsall continue to treat satisfactorily the whole of the sewage of the borough. At Willenhall also the still newer works are yielding good results, and from the Bilston and Wednesbury works the usual good effluents continue to be discharged. At Tipton the new works are giving satisfactory results, and progress has been made in connecting the houses with the new sewers. The construction of the new works at Darlaston has not yet been commenced, owing to the fact that the sanction for the necessary loan has been postponed on account of the war. For the same reason the contemplated extension of the works at Oldbury and West Bromwich has been postponed.

In the north of the county, apart from one or two unimportant temporary irregularities, which have been corrected on representations being made, the numerous works constructed during recent years, and the effluents from which discharge into the Trent or its tributaries, have proved to be quite equal to dealing with the sewage of the large populations which they serve.

Besides one or two smaller schemes which have been hung up for the present, schemes for Audley and the borough of Stafford, the former being an entirely new scheme, and the latter an important extension, have also been suspended because of the war.

MUNITION WORKS EFFLUENTS.

Dr. Reid regrets to say that in various parts of the county streams have suffered owing to the establishment of munition works from which highly polluting effluents are discharged. These effluents, he says, are most difficult to deal with, and, under the circumstances, there is no possible remedy. Incidentally, because of a greatly increased call for gas for munition works and the resulting excessive amount of tar products to be disposed of, a sudden and serious pollution of the river Tame took place from the Saltley gasworks belonging to the Birmingham Corporation, which resulted in the destruction of a large number of fish in the river Trent. The circumstances were inquired into jointly by the county council, the Birmingham Tame and Rea Drainage Board, and the Trent Fishery Board, with the result that steps were taken to prevent a recurrence of the pollution, and Dr. Reid understands that, by way of compensation, the Birmingham Corporation gave a grant to the Fishery Board of £100.

One other pollution which gave rise to the destruction of fish in the river Sow at Stafford was specially inquired into. Although it was not possible to trace this pollution to its definite source, circumstances rather favoured the view that it arose from some irregularity at the Stafford Gasworks. The inquiry failed to establish the fact that any pipe or drain from the gasworks communicated with the stream direct, but owing to the absence of any drain plan it was difficult to determine whether there was any indirect communication between the works and the stream. Since the occurrence steps have been taken by the engineer of the works to trace all the drains for the purpose of preparing an accurate plan.

Terms Used in Sewerage and Sewage Disposal.

AN AMERICAN COMMITTEE'S DEFINITIONS.

Considering that it would be advantageous to the engineering profession, and to others interested in the construction and maintenance of sewerage works, to have the meanings of the terms most commonly used in sewerage and sewage disposal practice clearly defined, a committee of the American Public Health Association have issued the following preliminary report in the hope that it may bring out a full discussion of the subject. The definitions of the terms will be revised in accordance with the weight which may be given in the suggestions and criticisms received, the desire of the committee being to establish terms which may be generally acceptable to all engaged in the work of sewerage and sewage disposal. The members of the committee are Messrs. George S. Webster, Philadelphia (chairman); Frank A. Barbour, Boston; Kenneth Allen, New York City; Langdon Pearse, Chicago; and W. C. Hoad, Ann Arbor, Mich. Messrs. William T. Carpenter, Harrison P. Eddy, Edwin J. Fort, George W. Fuller, George T. Hammond, Paul Hansen, Alfred H. Hartman, T. Chalkley Hatton, George A. Johnson, A. Elliott Kimberly, William L. Stevenson and Robert Spurr Weston have materially aided in the preparation of the report.

SEWERAGE.

(1) SEWAGE.

Sewage is the spent water supply containing the wastes from domestic, industrial, or commercial use, including such surface and ground water as may enter the sewer.

(*a*) Domestic Sewage is that discharged from residences or institutions, and contains water-closet, laundry, and kitchen wastes.

(*b*) Industrial Wastes are the liquid wastes resulting from the processes employed in industrial establishments.

NOTE.—In the opinion of the committee the term "industrial wastes" is preferable to "trade wastes."

(*c*) Street Wash is the liquid flowing on and from the street surface.

(2) DRAINAGE.

(*a*) Surface Water is that portion of the precipitation which runs off over the surface of the ground.

(*b*) Storm Water is that portion of the precipitation which runs off over the surface of the ground during a storm, and for such a short period following a storm as the flow exceeds the normal or ordinary run-off.

(*c*) Ground Water is that which is standing in or passing through the ground.

(3) DRAIN.

Drain is a conduit intended to carry storm, surface and ground water.

(4) SEWER.

Sewer is a conduit for carrying sewage.

(*a*) Common Sewer is a sewer in which all abuttors have equal rights of entrance and use.

(*b*) House Connection is a pipe leading from a building to a common sewer.

(*c*) Lateral Sewer is a sewer which does not receive the sewage from any other common sewer.

(*d*) Sub-main or Branch Sewer is a sewer into which the sewage from two or more lateral sewers is discharged.

NOTE.—The committee is of the opinion that preference should be given to the term "Sub-main sewer" rather than to "branch sewer."

(*e*) Main or Trunk Sewer is a sewer into which the sewage from two or more sub-main or branch sewers is discharged.

(*f*) Outfall Sewer is a sewer extending from the lower end of the collecting system to the point of final discharge into a body of water, or to a sewage treatment plant.

(*g*) Separate Sewer is a sewer which is intended to receive only sewage, and not storm water or surface water.

NOTE.—In the opinion of the committee the use of the term "separate sewer" is preferable to "sanitary sewer," which latter term should be discontinued.

(*h*) Combined Sewer is a sewer intended to receive both sewage and storm and surface water.

(*i*) Intercepting Sewer is a sewer generally laid transversely to the general sewer system to intercept all the sewage collected by the sewers of a separate system or the dry-weather flow of sewage, and such additional storm and surface water as may be determined from a combined system.

(*j*) Relief Sewer is a sewer intended to carry a portion of the flow from a district already provided with sewers of insufficient capacity, and thus prevent overtaxing the latter.

(5) SEWER SYSTEM.

Sewer System is the collecting system of sewers and appurtenances, together with such small pumping stations as may be required to lift the sewage from low-level districts.

(*a*) Combined System is a system of combined sewers.

(*b*) Separate System is a system of separate sewers.

(6) SEWERAGE WORKS.

Sewerage Works comprise the sewer system, main pumping stations, treatment works, means of disposal of effluent and sludge, and all other works necessary to the complete collection, treatment and disposal of the sewage.

(7) SEWER APPURTENANCES.

(*a*) Manhole is a shaft, or chamber, leading from the surface of the ground to the sewer, large enough to enable a man to gain access to the latter.

(*b*) Lamphole is a small vertical pipe, or shaft, leading from the surface of the ground to the sewer, for admitting a lantern or reflected light for purposes of inspection.

(*c*) Wellhole, or Drop Manhole, is a vertical shaft in which sewage is allowed to fall from one sewer to another at a lower level.

(*d*) Inlet is a direct connection between the surface of the ground and the sewer, for the admission of surface or storm water.

(*e*) Catch Basin is a chamber inserted in an inlet to prevent the admission of grit and other coarse material into the sewer.

(*f*) Flush Tank is a tank in which water or sewage is accumulated to be quickly discharged later, for the purpose of flushing the sewer.

(*g*) Regulator is a device for controlling the quantity of sewage admitted to an intercepting sewer.

(*h*) Outlet is the end of a sewer or drain from which its contents are finally discharged.

(*i*) Storm Overflow is a weir or orifice for permitting the discharge from a combined sewer of that portion of the storm flow in excess of that which the sewer is intended to carry.

SEWAGE DISPOSAL.

(8) GENERAL TERMS.

(*a*) Sewage Disposal is a generic term applied to the act of disposing of sewage matter by any method.

(*b*) Sewage Treatment is the process to which sewage is subjected in order to partially remove its impurities and render it fit for final discharge.

NOTE.—The term "Sewage Purification" should be abandoned.

(*c*) Contamination is the introduction into a water of bacteria or other substances which tend to render it unsuitable for domestic use.

(*d*) Pollution is the introduction into a water of substances of such character and in such quantity that they tend to render the body of water or river objectionable in appearance, or to cause it to give off objectionable odours.

(*e*) Influent in sewage practice is a term which applies to sewage that flows into any sewage treatment device.

(*f*) Effluent in sewage practice is a term which applies to sewage that flows out of any sewage treatment device.

(*g*) Putrescibility is the capability of sewage, effluent, or wet sludge to putrefy the conditions to which it is subjected.

(*h*) Stability is the capability of sewage or effluent to resist putrefaction under conditions to which it is subjected.

(*i*) Relative Stability is the ratio of available oxygen to the oxygen required to prevent putrefaction, expressed in per cent.

(*b*) Clarification: ... the removal of the suspended ... material ...

(*c*) Suspended Solids are the solids, both organic and inorganic, that are not held in solution in a sewage or effluent ... solids being quantitatively determined in the laboratory by retention on filter paper.

(*d*) Settling Solids are those suspended matters which will ... from the quiescent sewage in a specified length of time.

(*e*) Sludge. Matter in suspended matter which is so ... that it is no longer acted on by gravity, and remains suspended indefinitely, yet will not pass through a ... membrane in the ordinary process of analysis.

SCREENS.

(*a*) Screens are ... containing openings of proper size to arrest ... of the suspended matter of sewage.

(*b*) Coarse Screens are those having openings in excess of ... in greatest dimension.

(*c*) Fine Screens are those having openings of ½ in. or less, in least dimension.

(*d*) Bar Screens are those composed of parallel bars or rods.

(*e*) Mesh Screens are composed of a fabric, usually of wire.

(*f*) Gratings. A grating consists of two sets of parallel bars in the same plane, the sets intersecting at right angles.

(*g*) Perforated Plate Screens are those of perforated plates.

(*h*) Band Screens are those consisting of an endless band or belt which passes over upper and lower rollers.

(*i*) Wing Screens are those having vanes at known spaced, which rotate on a horizontal axis.

(*j*) Drum Screens are those in the form of a cylinder or cone, consisting of perforated plates or a wire mesh which rotates on a horizontal axis.

(*k*) Disc Screens consists of a rotating circular perforated disc, with or without a central truncated cone of similar material mounted on the centre.

(*l*) Cage Screens consists of a cage having three sides made of parallel bars or rods, so arranged that it may be lowered into the sewage and raised therefrom for cleaning.

(10) TANK TREATMENT.

Tank Treatment is the detention of sewage or sewage sludge in tanks, either quiescent or with continuous flow.

(*a*) Grit Chamber. A chamber or enlarged channel in which the cross section of sewage flow is so designed that the velocity is such that only heavy solids, such as grit and sand, are deposited, while the lighter organic solids are carried forward in suspension.

(*b*) Sedimentation Tank is a tank for the removal of suspended matter either by quiescent settlement or by continuous flow at such a velocity and time of retention as to allow deposition of suspended matter.

(*c*) Dortmund Tank is a vertical sedimentation tank, usually cylindrical, to which the raw or partially treated sewage enters the lower part, flows upward and passes out near the top. The sludge is drawn before it becomes septic from the conical or hopper-shaped bottom.

(*d*) Hydrolytic Tank is a tank in which by biological processes a portion of the suspended matter is converted into liquid and gaseous form.

(*e*) "Septic" Tank is a horizontal, continuous flow, one-storey sedimentation tank through which sewage is allowed to flow slowly to permit suspended matter to settle to the bottom, where it is retained until anaerobic decomposition is established, resulting in the changing of some of the suspended organic matter into liquid and gaseous substances and a consequent reduction in the quantity of sludge to be disposed of.

(*f*) Travis Tank is a two-storey tank consisting of an upper, or sedimentation, chamber, with steeply sloping bottom, terminating in one or more slots through which the solids may slide as deposited into the lower or sludge-digestion chamber, through which a predetermined portion of the sewage is allowed to pass for the purpose of seeding and maintaining bacterial life in the sludge and carrying away decomposition products, thus inducing digestion of the sludge attended by a reduction in volume.

(*g*) Imhoff or Emscher Tank is a two-storey tank consisting of an upper, or sedimentation chamber with steeply sloping bottom, terminating in one or more slots through which the solids may slide as deposited into the ... or sludge-digestion chamber, these slots being trapped so as to prevent the rise of gas and solids from the lower chamber, the lower chamber being provided with vents for the escape of the gases, the tank being so constructed as to facilitate the passage of the sewage quickly through the upper chamber and prevent the flow of sewage through the digestion chamber, and so operated that the sludge may be thoroughly decomposed, rendered practically free from offensive odour, and so filled with gas that it can be readily drawn off and dried.

(*h*) Activated-sludge Process consists in the agitation of a mixture of sewage with about 15 per cent or more of its volume of bacterially active liquid sludge in the presence of ample atmospheric oxygen, for a sufficient period of time to at least coagulate a large proportion of the colloidal substances, followed by sedimentation adequate for the subsidence of the sludge floccuti, the activated sludge having been previously produced by aëration of successive portions of sewage and maintained in its active condition by adequate aëration by itself or in contact with sewage.

(*i*) Chemical Precipitation consists in adding to and thoroughly mixing with the sewage such chemicals as will, by reaction with each other or with the ingredients of the sewage, produce a floccuent precipitant, and subsequent sedimentation.

(11) SLUDGE.

Sludge is the suspended matter of the sewage deposited in tanks or intercepted at the surface of filters, mixed with more or less water.

(*a*) Sludge Digestion is the biological process by which organic matter in sludge is gasified, liquefied, mineralised, or converted into stable organic matter.

(*b*) Separate Sludge Digestion is the digestion of sludge in tanks entirely independent from the tanks in which it is produced.

(*c*) Sludge-drying Bed is a natural or artificial layer of porous material upon which sludge is dried by drainage and evaporation.

(*d*) Sludge Concentration is the process of reducing the volume of sludge, and increasing its proportion of solids by allowing it to stand in a suitable tank until the solids settle down, and drawing off the relatively clean water at the top.

(*e*) Sludge Drying is the process of drying sludge by natural or artificial heat.

(*f*) Sludge De-watering is the process of removing a portion of the water contained in the sludge by draining, pressing, centrifuging, or by other natural or mechanical processes.

(*g*) Sludge Pressing is the process of de-watering, by the exertion of pressure, the solids being retained by a cloth fabric, which permits the water to pass through it.

(*h*) Sludge Cake is the mass of de-watered sludge resulting from sludge pressing.

(12) MISCELLANEOUS.

(*a*) Scum is a floating mass of sewage solids buoyed up in part by entrained gas or grease, forming a greasy mat, which remains on the surface of the sewage.

(*b*) Screenings constitute the material removed from sewage by screens.

(*c*) Grit is the heavy mineral matter deposited from sewage.

(*d*) Sleek is the oily film of microscopic thickness present on the surface of waters, about and often extending a considerable distance from sewer outlets.

(13) SEWAGE OXIDATION.

Sewage Oxidation is the process whereby through the agency of bacteria, in the presence of air, the organic matter is converted to a more stable condition or into mineral matter.

(*a*) Irrigation is the generic term applied to the process of sewage treatment in which the sewage is applied to land for the primary purpose of purifying the sewage and the secondary purposes of supplying water and fertiliser to crops.

(*b*) Surface Irrigation is the process in which sewage is applied to and distributed over the surface of cropped ground.

(*c*) Sub-surface Irrigation is the process in which sewage is distributed beneath the surface of the ground by means of open-jointed pipes.

(*d*) Sewage Farm is an area of land on which crops are raised and to which sewage is applied on or beneath the surface of the soil and is absorbed by vegetation, evaporates, or percolates to the ground water.

(*e*) Intermittent Filter is a natural or artificial bed of sand or other fine-grained material to which sewage is intermittently applied in doses, and which by its capillarity holds the sewage for a time sufficiently long.

in the presence of air, to effect by biological processes a high degree of purification.

(*f*) Contact Bed is a watertight basin filled with coarse material, such as broken stone, in contact with which the sewage is for a time held by control of the underdrains, the cycle of operation involving periods of filling, standing full, emptying, and resting empty, so regulated as to secure such contact with the bacterial films adhering to the surface of the coarse material, and such aëration of the bacterial surfaces as may be required to oxidise the sewage.

(*g*) Slate Bed is a tank filled with slabs of slate or other similar material laid horizontally and spaced an inch or more apart vertically, equipped so that it may be filled with sewage, allowed to stand full for a definite period of time, drained and allowed to stand empty for a time, for the purpose of oxidising the organic matter deposited upon and adhering to the slates.

(*h*) Trickling Filter is an artificial bed of coarse material, such as crushed stone or clinkers, over which the sewage is distributed as a spray from fixed nozzles or as a film from moving distributors, through which it trickles to the underdrain system, coming in contact with the bacterial films adhering to the surface of the stones, and in which such aëration of the bacterial surfaces as may be required to oxidise the sewage is afforded.

Note.—The committee is of the opinion that the term "trickling filter" is preferable to the term "sprinkling filter" or "percolating filter."

(*i*) Dosing Apparatus is the apparatus used for regulating the application of sewage to filters or for applying the required quantity of chemicals to sewage.

(*j*) Sprinkler Nozzle is a nozzle used for applying sewage in the form of a spray to trickling filters.

(*k*) Distributor is a movable pipe or channel which distributes sewage upon the surface of a trickling filter. There are two types of distributors—the rotary and the travelling—the rotary moves about a central axis with delivery to a circular filter; the travelling moves back and forth the length of a rectangular filter.

(*l*) Dosing Tank is a tank into which raw or partially treated sewage is introduced and held until the desired quantity has been accumulated, and then discharged at such a rate as is necessary for the distribution essential to the subsequent treatment.

(14) DISINFECTION.

Disinfection is the destruction by the agency of some chemical of a large percentage of the bacteria in sewage or contaminated water, so as to reduce the danger of infection to a negligible quantity.

(15) STERILISATION.

Sterilisation is the destruction by the agency of some chemical of all the bacteria in sewage or contaminated water, including their spores.

(16) NUISANCE.

Nuisance (in relation to a polluted stream) is a condition which is offensive to the sense of sight or smell.

(17) A CLEAN RIVER.

A Clean River, in regard to sewage, is one which gives no sensuous evidence of sewage pollution, and from which a wholesome drinking water can be obtained by practicable methods of water purification.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ
(One man does not see everything.)
—Euripides.

PUBLIC UTILITY SOCIETIES AND HOUSING.

To the Editor of The Surveyor.

Sir,—I read with interest your note upon the work of public utility societies and my report on the work which the future holds for these bodies. I am the more obliged because, apparently, it has appeared to you that I have brought into competition public utility society work and municipal enterprise. May I be allowed to say that that certainly was not the purport of my report?

Naturally, in speaking to representatives of public utility societies and urging their point of view I put forward *their* claims, and the points wherein they seemed to possess advantages, but I think a second reading will show you that a considerable part of my paper was devoted to the question of co-operation with municipal authorities, and that what might be called the constructive part dealt with the giving of increased powers to local authorities to effect that co-operation. Indeed, out of twenty-one clauses in the proposed "policy," fifteen deal with co-operation with local authorities.

Personally, I think that the main and perhaps the only point where the public utility society can, under all circumstances, show a decided advantage over other forms of enterprise is in regard to the social work which is being so splendidly carried on, especially in the co-partnership societies now existing.—Yours, &c.,

Ewart G. Culpin,
Secretary.

3 Grays Inn-place, W.C.
November 1, 1916.

MUNICIPAL SCHEMES AFTER THE WAR.

Kensington B.C.—The borough council express the opinion that the undermentioned works should be carried out with as little delay as possible after the close of the war. The laying of wood paving in Brompton-road, estimated cost, £11,000; Young-street, £285; Cambridge-gardens (on new foundation), £3,500; a bituminous paving in the portion of Holland-road northward of Napier-road, £5,500; and the construction of further egress manholes in connection with the council's sewers, £2,000. These are works urgently needed. The wood paving in Cromwell-road, West Cromwell-road, Cromwell-crescent, Warwick-gardens, and St. Quintin-avenue is at present in a very unsatisfactory condition, and will require renewal on a new foundation in the near future. The cost of carrying out this work is estimated at £59,000. It is less urgent, but necessary at an early date. Other proposed schemes are repaving of footways, estimated to cost £4,000; laying out a children's playground at Notting Hill, at an estimated cost of £1,500; and certain street widenings.

Southport T.C.—It has been decided to recommend the proposed development of the lagoon site, at an estimated cost of £9,000, and the borough surveyor, Mr. A. E. Jackson, has been instructed to prepare a scheme for the development of the foreshore from Hasketh-road extension to the Birkdale boundary, the main front of Southport.

Sunderland T.C.—It is proposed to execute the following works: Health Committee—Alterations and additions to borough sanatorium and mortuary. Highways—Street works; expenditure estimated at £28,550. Markets and baths—Salt-water bath at Roker. Parks—Repairs to sea wall, Sea-lane, and erection of lodges, Barnes Park. Bridge and ferries—Widening and improvement of Wearmouth Bridge. Town hall—Town hall extensions. Cemeteries—Extension of Bishopwearmouth cemetery. Electricity and lighting—Laying of mains, in connection with which there will be a quantity of street work. Education—Secondary school for boys (Bede Collegiate), levelling of site, road making; alterations to secondary school for girls (Bede Collegiate); training college scheme; domestic science centre (Thomas-street); alterations to public elementary schools, Moor (girls and infants); and Stansfield-street (girls). Committee as to children's playgrounds—Work in connection with recreation ground, Cumberland-terrace.

Wigan T.C.—The town clerk has been instructed to include in the schedule of works a ladies' swimming bath as an addition to the present baths; baths in the Pemberton district; and public wash-houses.

Wood Green U.D.C.—The proposed works include the following: Green-lanes reconstruction of roadway, £20,000; asphalt macadam, St. Ann's-road and West Green-road, £16,000. Culverting Stonebridge Brook, South Tottenham Goods Yard, £6,000.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

The Surveyor

And Municipal and County Engineer.

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BRITISH DE-TINNING COMPANY'S SCHEME.

A THREE DAYS' CONFERENCE OF LOCAL AUTHORITIES.

The conference of local authorities at which the British De-Tinning Company will outline the scheme by which those bodies will be enabled to dispose on a profit-sharing basis of their accumulations of waste metals, has now been definitely fixed to take place at Caxton Hall, Westminster, on December 13th, 14th and 15th next.

As is well known, the de-tinning business was before the war solely in the hands of the Germans. Through their agents they bought the waste tins and other metals from the municipal authorities, crushed them by means of steam rollers and shipped them to Germany, where the tin, or zinc, as the case might be, was extracted. The plates were then melted down and the steel was converted into light rails and many other articles, some of which came back to this country in the shape of bric-à-brac, toys, &c. The business must have been of a profitable nature, as the Germans not only bought this waste material in large quantities from Great Britain, but also from Canada, Australia, South Africa, and other Colonies.

The British De-Tinning Company, whose head office is now at 47 Victoria-street, S.W., are devoting their energies to cope with the increasing accumulation of waste metals in this country, and effectually to retain the business here. Arrangements have already been made with the boroughs of Southwark, Wandsworth, and Southend-on-Sea to take over all their waste metals for a term of years upon such terms as are mutually acceptable to the parties. The company propose to erect buildings at various depots, and to instal plant to de-tin or de-galvanise the material, and cut open and flatten out the plates and to prepare them for the market. They are fully confident of the success of their enterprise, and are convinced that once they have secured the trade the work cannot be profitably dealt with abroad, for the reason that transit involves the crushing and melting of the plates and the remanufacture of the steel.

Mr. Henry Cust, chairman of the Central Committee of National and Patriotic Organisations, has promised to preside at one of the meetings next month, and other influential men have promised to speak.

Heating and Ventilating Dwelling-houses.—A paper on this subject, read at the last meeting of the Society of Engineers, will appear in our next issue.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not rather refreshing to find that the chairman of the Kingston, co. Dublin, Urban District Council, who represented that body at the conference of the Association of Municipal Authorities held recently in Belfast, has been struck with the great advantages of such gatherings? While it is often contended that no advantages accrue from such meetings, and the Local Government Board make a practice of disallowing the expenses of officers attending them, is it not rather strange that the chairman of this urban district council is able to speak in the most eulogistic terms of the benefit he had derived from attendance at the conference referred to?

* * * *

Would it not be more to the purpose if everyone in this country concentrated their time, energies, and thoughts on the best manner of finishing the war, instead of "side tracking" on to what we are going to do *after* the war? Is there not a well-known adage, "First catch your hare before you talk about cooking him," which applies very forcibly in this connection?

* * * *

Is it not to the credit of the highways and sewerage department of the Sheffield Corporation that in their report for the year ended March 31st last they should have stated that "a large amount of work has been involved in looking after dependents of men who have joined the Forces, and that it had not been considered sufficient merely to pay over the allowances granted by the corporation, but every effort had been made to keep in touch with the various families, and to see that no hardship was suffered which could be avoided by the exercise of a little care"? Cannot we all say, "Well done, Sheffield!"?

* * * *

Is it not a step in the right direction when we find that the Ministry of Munitions propose to open an instructional workshop in one of the suburbs of London for the training of 200 women in mechanical engineering? Is it not evident that, if women are only given the chance of training, there are many occupations, now supposed to be only suitable for men, which they could take up with advantage to themselves and to the benefit of the nation?

* * * *

Is there not a great deal to be said in favour of Mr. Reginald Brown's suggestion that house refuse should be utilised instead of being destroyed? Is it not evident that if he can make combustible briquettes from this material there will be a vast field for economy in a direction which appeals to all householders, as well as a source of profit to the ratepayers? Did not Mr. H. G. Coales, the surveyor of Market Harborough, once try to make somewhat similar briquettes which were not altogether successful as fuel? In what way do Mr. Brown's operations differ from those of Mr. Coales?

* * * *

Does it not seem to be a pity that we should burn house refuse, which only has a calorific value of about one-twelfth that of steam coal, when we know that this waste product contains articles which since the war have increased enormously in value? When shall we realise that there is still a fortune in the dustbin if only the materials which it contains could be collected and sorted on scientific and sanitary principles?

* * * *

Having searched in vain through the plays of Shakespeare—or Bacon—for any allusions to the condition of the roads at the time in which he wrote, or any hint as to the sanitary conditions then prevailing, can any of the readers of this column give any suggestions or quotations that will assist?

* * * *

Should not the Roads Improvement Association be glad that their efforts to obtain some further legislation with regard to lights on vehicles, and similar precautions with regard to animals, on our highways, have at last been crowned with success, and that orders have now been issued which meet all the difficulties which have been so persistently pointed out by this association for some time past? Should not this association also be congratulated on having secured the services of Mr. J. D. Haworth as secretary during the temporary absence of Mr. Wallace E. Riche, who has joined H.M. Forces?

A Note on Cart Wheels and Tyres.

By T. SALKIELD, M.INST.C.E., Municipal Engineer, Delhi.

[In our issue of October 20th reference was made by our contributor of "Things One Would Like to Know" to the extensive damage caused to macadam road surfaces in Indian cities by what are known as byle gharries, springless carts with wheels "shod with half-round iron." How serious is the problem which these vehicles have created is made clear in the following short paper read by Mr. Salkield at an All-India Sanitary Conference.]

The city of Delhi is most unfortunate in the type of vehicle generally used for the transportation of heavy merchandise and building materials. This vehicle,

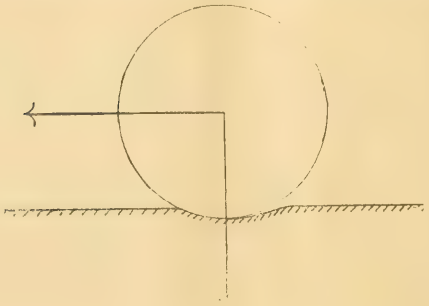


Fig. 1.

known as a *thela*, is unprovided with springs, and is the Indian champion road destroyer. For several years the author has been trying to get the municipality to take steps to improve this type of vehicle, and many of the notes embodied herein are extracts from reports prepared by him on the subject in his capacity of municipal engineer.

The following dimensions are the averages of sixty *thelas* taken at random on the streets of Delhi:—

Diameter of front wheels . .	1 ft. $7\frac{3}{8}$ in.
Width of tyres	2·44 in.
Diameter of back wheels	2 ft. $6\frac{3}{8}$ in.
Width of tyres	2·53 in.

The diameter of front wheels ran from 1 ft. 4 in. to 1 ft. 10 in., and back wheels from 2 ft. to 2 ft. 10 in.

The least tyre width was found to be $2\frac{1}{4}$ in., and the greatest $2\frac{3}{4}$ in.

When it is known that these carts frequently carry 60 maunds (20 maunds above the maximum allowed for four-wheeled vehicles), it is easy to understand their road-destroying capacity.

The resistance to the rolling of one body on another is so very complex and offers so many mathematical problems that a series of papers with calculations could be written, but it is not the intention of the author to submit mathematical investigations to

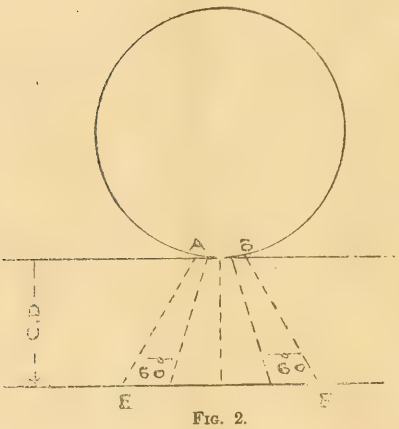


Fig. 2.

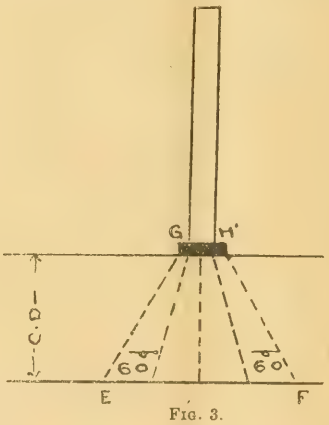


Fig. 3.

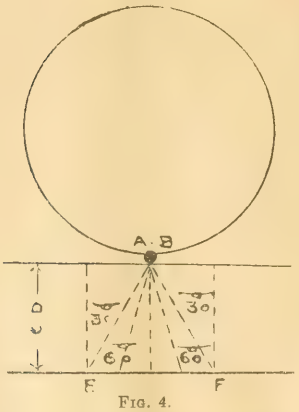


Fig. 4.

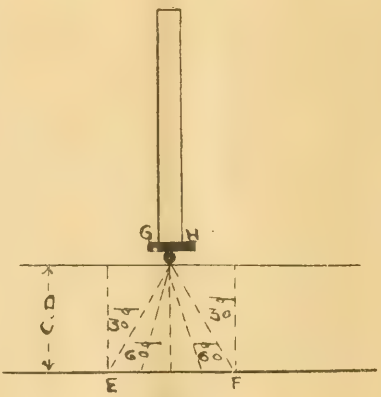


Fig. 5.

prove, among other things, that in resisting compression the stresses diminish as the area of action increases, but rather by means of a few broad facts

to have a certain relation to about the width of cart tyres.

The points to be considered in dealing with this subject are:—

1. Structural features of road or roads and resisting surface.
2. Width of resisting unit width of surface of carriageway.
3. Radius and [illegible] of surface to contact.
4. Friction between roller and resisting surface, especially [illegible] to shearing stresses.
5. Angle of [illegible] resisting surface.
6. Effect of [illegible] centre of gravity to the wheels.

The materials of ordinary water-bound macadam are of a much more elastic character than the materials of which the wheels of any vehicle are constructed, consequently [illegible] by the passage of wheels over such roads is expended in distorting the surface and pulverising the particles of which it is composed, and forming a rut out of which the wheel is constantly endeavouring to climb, as described in Fig. 1.

In all spring-less hauling carts no attempt is made to reduce the friction of the wheel upon its axle, and consequently the power to be overcome is much increased and the friction between the road surface and the wheel-tyres is [illegible]. The extent of such retardation depends upon the unevenness and compressibility of the road and the force necessary to overcome it, which may be assumed to be inversely proportional to the diameter of the wheel. The larger the wheel the smaller is the resistance to rolling, and consequently the more easily are all road inequalities and obstructions overcome.

In Delhi daily a [illegible] load of small broken stones for concrete work or road renewals is dropped on to the roads from the antediluvian type of carts in use. These obstacles cause incalculable damage to the small wheeled, springless vehicles coming into contact with them and causing the energy that is being expended in a horizontal direction to be converted into a vertical force acting downwards, tending to disintegrate the road surface.

The close relationship that exists between wheel diameter and tyre width, and the pressure acting upon a smooth road surface, and the concentration of such pressure on an uneven surface or obstruction is shown in Fig. 2.

A—B Arc of wheel in contact with road.
C—D Thickness of road crust.
E—F Lines of pressure.
G—H Width of tyre.

From this it will be seen that the distributed pressure per square inch on the subsoil must of necessity vary with:—

(1) Diameter of wheel.
(2) Width of tyre.
(3) Thickness of road metal.
(4) Camber and evenness of road surface and freedom from obstructions;

and that, consequently, any authority in making by-laws should very carefully study the relations that exist between loads, width of tyres, diameter of wheels, and the general character of the roads in their district.

Such by-laws should also contain very stringent clauses giving power to the authorities to prevent the dropping of material from carts on to any public road.

The author has noticed in his study of this subject that the damage done in consequence of the small wheels and narrow tyres of the Delhi *thela* is aggravated by the disrepair of the vehicles, as the owners allow excessive play between nave and axle and he is frequently reminded of the cutting knives on the wheels of ancient war chariots by the presence of the old horseshoes doing duty for pins in keeping wheels on axle, which facts should also be remembered when preparing by-laws.

The author is of opinion that it is advisable to embody in this paper the following general results of experiments that have been made upon the resistance to traction of vehicles on ordinary roads:—

(1) The resistance to traction is directly proportional to the load and inversely proportional to the diameter of the wheel.

(2) Upon a [illegible] hard macadamised road the resistance is independent of the width of the tyre when such quantity exceeds 4 in.

(3) At a walking pace the resistance to traction is the same under such circumstances for carriages with and without springs.

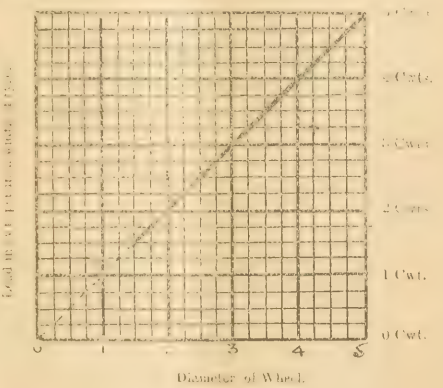
(4) Upon hard roads the resistance to traction increases with velocity.

(5) Upon soft roads, earth, sand, and turf the resistance to traction is independent of velocity.

(6) Upon compact stone paving the resistance to traction at a walking pace is not more than three-fourths of the resistance upon the best macadamised roads under similar circumstances.

(7) Road destruction is, in all cases, greater, as the diameters of the wheels are less and is greater in carriages without than in those with springs.

Having regard to these facts, the maximum load that should be allowed on springless carts with wheels 5 ft. diameter should not, in the author's opinion, exceed 2 cwt per inch-width of tyre, and this should decrease in a regular ratio with the diameter of the wheels, as shown by the following diagram.



In conclusion, it must be stated how very difficult it has been to keep from writing about road construction, as the relationship between cart wheels and roads is so very intimate.

RURAL COUNCIL AND LABOUR SHORTAGE.

THE IMPORTANCE OF ROAD UPKEEP.

At the last meeting of Langport, Somerset, Rural District Council, the chairman, dealing with a statement of the surveyor as to the local shortage of labour, remarked that the matter was one that required the serious consideration of the council, and although he was chairman of the tribunal, which he hoped would continue to do its best for the country, speaking as chairman of the district council he considered they should do their best for their own interests.

The surveyor said that at present there were three men appealing to Taunton.

Mr. Lang said he considered it was a very serious position indeed. He for one strongly supported appealing for the men. The time had arrived when they must do something. If the roads were allowed to get back into the fearful state they were once in the ratepayers in the future would have to pay heavily for their reconstruction. He proposed that the surveyor should be empowered to go to Taunton to get the men if possible.

The surveyor said that in many cases there was only the contractor and perhaps one man left on the roads. It was really getting serious.

The chairman thought the surveyor should make out a list of the whole of the men for whom appeals were likely to be made, to place before the tribunals.

Mr. Lang said that could be done during the next fortnight. In the meantime the surveyor could be instructed as to what he should do.

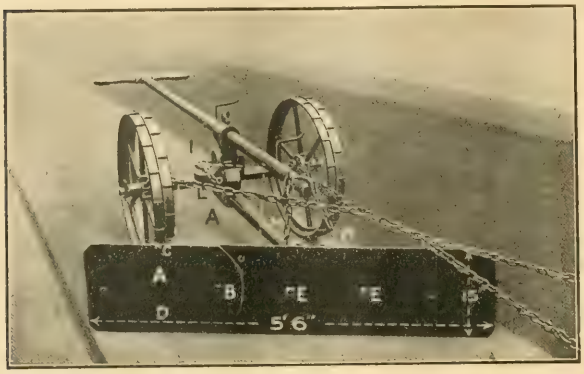
Mr. Lang's proposition was agreed to.

Contractors' War Bonus.—In view of the increase in wages and prices of materials, Tredegar Urban District Council have granted a war bonus of £100 to Messrs. Barnes, Chaplin & Co., Cardiff, the contractors for the district sewerage scheme.

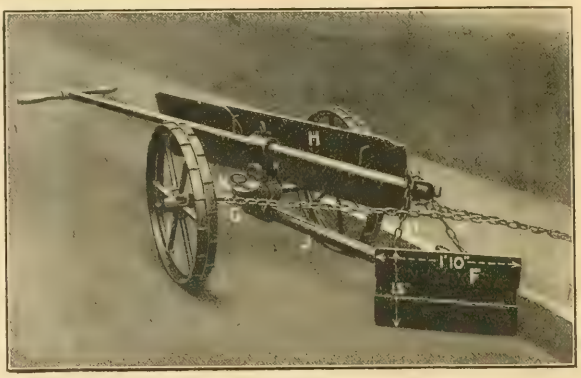
ECONOMICAL SNOW REMOVAL.

THE SUTCLIFFE PLOUGH.

In view of their severely depleted staffs, local authorities are unlikely to view with entire equanimity the approach of winter. As even the casual labour which in former years was always available for the work of snow removal will in all probability be practically unprocurable, officials upon whom falls the responsibility of keeping clear the roads and streets within their districts will be interested in the accompanying views illustrating the operation of Sutcliffe's patent snow plough.



Sutcliffe's Footpath Snow Plough with Movable Extension.
(Position of Extension (A) when raised is shown by dotted lines.)



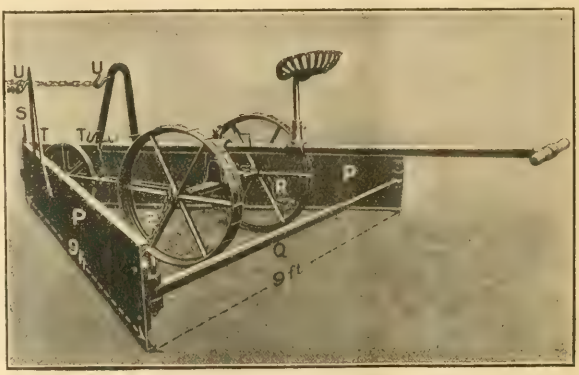
Footpath Plough with Blades Detached leaving Narrow Casting (F) for Channels.
(Footpath blade (H) is carried on hooks of steering arm when channel ploughing.)

The latest design, we are informed by the manufacturers, the Patent Snow Plough Company, of Mytholmroyd, Yorks, is fitted with a movable extension which can be raised perpendicularly by the driver to avoid lamp pillars, &c., and the footpath blade can be detached, leaving a narrow casting for channels only which does not throw the snow too far into the roadway. This is one important phase in the work of the plough, as when the channels are cleared the gullies have a chance to take the water when a thaw sets in. The angle at which the blade works can be altered in a very simple manner to suit the conditions.

The chairman of a local council, after viewing one of the firm's machines and the work it had done, is said to have stated that its general adoption would mean a saving of thousands of pounds to ratepayers, as it would do the work of 75 to 100 men, and save its own cost on the first day of using.

The road plough is capable of clearing anything from 6 ft. 6 in. to 9 ft. of roadway. It runs wholly on wheels, and requires only one man to work it. The blades consist of 18-in. by ¼-in. by 9-ft. boiler plating, and can be adjusted so as to work clear of the ground. The width of the plough can be varied by a very simple device.

The firm also supply ploughs for use in roadways only, these being constructed on exactly the same principle as the one just described, except that they are not fitted with footpath and channel blades. Another type in which the blades are constructed of hard wood shod with iron is recommended as suitable for use in rural districts.



Footpath Plough Converted into Road Plough.
(Showing telescopic arrangement (Q) by which width of plough can be varied.)

Edinburgh Public Wash-houses.—The sixth public wash-house erected by Edinburgh Corporation was opened last week. The building, which has been erected in M'Leod-street, Gorgie, at a cost of £6,500, is provided with forty stalls and improved washing and drying appliances. A crèche has been included, where young children may be cared for while their mothers are engaged in the wash-house.

Diaries for 1917.—The Boots Pure Drug Company, Limited, whose head offices are at Station-street, Nottingham, are among the first in the field with the 1917 diaries. Notable among them are their thoroughly practical foolscap diaries, interleaved with blotting-paper; their "Home Diary," which includes a most invaluable section of information on all sorts of subjects which affect the interests of a householder and his household; and pocket diaries, daintily bound, and fitted with back-loop pencil. A Boots diary is synonymous with good material and workmanship and liberal value for money.

Indispensable.—A well-known Chicago consulting engineer writes: "Some time ago I ordered you to discontinue my subscription, but I have concluded that I must continue the paper. Will you therefore kindly continue my subscription and send me invoice"?

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bacup T.C.—The Parks Committee have instructed the borough surveyor, Mr. W. H. Elce, to prepare an estimate for converting into a shelter the lodge at the entrance to the park, and also for building a wall.

Barnstaple T.C.—The question of providing a mortuary is being considered in committee.

Bournemouth T.C.—The borough engineer, Mr. F. P. Dolamore, has prepared a report in which he suggests improvements at the entrance to the pier, at an estimated cost of £5,000. The town council do not propose to deal with the matter during the war.

Stoke-on-Trent T.C.—Acting upon the report of the borough surveyor, Mr. A. Burton, and after communication with the Local Government Board, it has been decided to prop the rest of the Burslem Town Hall, and not proceed with the work of reconstruction until after the war.

Toronto T.C.—It is proposed by the city council to carry out a scheme of municipal improvements, at an estimated cost of £900,000.

MOTOR TRANSPORT.

Accrington T.C.—The Health Committee recommend the purchase of a motor vehicle at an estimated cost of £1,000.

Bournemouth T.C.—The Local Government Board are being asked to sanction a loan for the purchase of a motor fire engine and a motor chassis for an escape.

Consett U.D.C.—A motor wagon is to be purchased for the removal of house refuse.

Flaxton R.D.C.—The proposal to purchase a 5-ton steam tractor and two tipping wagons has been postponed for the present.

Inverness-shire C.C.—The Locherber District Committee have authorised the purchase of a motor car for the use of the road surveyor, Mr. C. J. M. Macintosh.

Margate T.C.—The Local Government Board having declined to sanction a loan for a motor fire engine, it has been decided to purchase one and pay the cost out of revenue.

Shipley U.D.C.—A report is being prepared with respect to the proposed purchase of a motor car for the fire brigade and other municipal purposes.

Spenborough U.D.C.—A proposition has been made for the purchase of a motor fire engine by private subscription.

Wolverhampton T.C.—It has been decided to purchase an electric lorry and car for use in connection with breakdown work on the tram lines.

ROADS AND MATERIALS.

Abercarn U.D.C.—The surveyor, Mr. John Williams, has been instructed to prepare an estimate of the cost of making the proposed new road at Kendon.

Arundel T.C.—The borough surveyor, Mr. E. F. Farrington, asked for instructions with reference to the purchase of road material which had been provided for in the estimates. He had ascertained that the cost of similar material to that obtained last year had advanced only 6d. per ton, and could now be bought at 11s. 10d. per ton on rail at Arundel Station. Alderman Whittaker, in moving that the borough surveyor be authorised to obtain 200 tons of material, said he should also like to point out that the gravel paths of the town were getting into a very bad state. It would be a great pity if, to save money on the rates, they starved the roads and paths. Some of the paths had worn away in the centre, and pedestrians had either to walk through pools of water or use the roadway, which was dangerous at night. He would include in his proposition that the surveyor inspect the paths and obtain gravel for their repair. The proposition was unanimously adopted.

Batley T.C.—A committee has been appointed to view Purlwell-lane for the purpose of a proposed widening scheme.

Belfast T.C.—The borough surveyor and engineer, Mr. H. A. Cutler, has been authorised to carry out a temporary widening of Mill-street, at an estimated cost of £140.

Cardiff T.C.—Alderman Sir J. Courtis asked at the council meeting last week what the policy of the Public Works Committee was with regard to the repairs of the chief thoroughfares in the city. The matter was, in his view, one of real urgency. Alderman Wm. Roberts said that their policy was the same as it had been for some time past. To relay the roads with timber at its present prices would be folly. Where they were able to tackle repairs without doing long lengths of road they were doing them. Alderman Sir John Courtis opposed the policy of waiting till the war was over. Although the price of timber was high, it was likely to remain high for some time after the war. Unless something was done they would soon have to start digging people and cars out of the roads. The matter then dropped. It is understood that it is the intention of Alderman Sir John Courtis to bring the matter up before the Public Works Committee.

East Riding C.C.—The Highways and Bridges Committee recommend that a grant be made not exceeding one-fourth of the balance of the cost of making the proposed new road from Folkton to Cayton, after the receipt of the contribution from the estate of the late Mr. G. N. Barnett, provided the Sherburn and Scarborough district councils would be prepared to make and maintain the portion of the road within their districts.

Hove T.C.—With respect to a request by residents for the removal of the trees in Lorna-road, the borough surveyor, Mr. H. H. Scott, reports that in four cases only are the trees at a less distance apart than 27 ft., and if anything were done in the matter it would be to prune the trees closely or remove them altogether. The Works Committee have adopted the borough surveyor's suggestion as to the trees being pruned, and with regard to trees on a vacant part of the road which are placed about 16 ft. apart it is proposed that alternate trees should be removed.

Johnstone T.C.—The burgh surveyor, Mr. W. A. Macartney, has been asked to obtain estimates of the cost of a steam roller.

London C.C.—On street widenings the London County Council is this year only spending £2,300; formerly it spent from £200,000 to £400,000.

Newry No. 2 R.D.C.—The council have agreed to a supplemental estimate of £100 for additional material for the road to Castleblayney.

Northampton T.C.—Two road rollers are to be purchased for £1,311, and a scarifier for £79.

Rotherham T.C.—The Improvements Committee recommend the town council to pass plans for a new street on Colonel Eastwood's estate.

Salop U.D.C.—It was stated by the chairman of the Roads and Bridges Committee, Mr. W. L. Southwell, that, owing to the increase of heavy traffic in the county, many of their roads and bridges were going from bad to worse. Over one road the heavy traffic was now so great that as much as £7,100, it was estimated, would have to be spent on the repair of it, although, as this increase of traffic was unforeseen, only a sum of £35 was provided for in the estimates for repairs. They were in communication with the War Office and the Road Board on the subject, and hoped that they would make them a substantial grant towards the extra cost. Owing to the increase of heavy traffic, too, several of their bridges had been damaged. Moreover, owing to the great shortage of labour and the consequent holding up of the necessary material, they were much hindered in the work of road repair. In reply to a question, Mr. Southwell said that the cost of the new bridge over the Severn at Cressage was £8,400.

Whitehaven R.D.C.—The surveyor, Mr. G. Boyd, has received instructions to report upon the condition of the roads from Middletown to Gill Bottom House, and from Middletown to Coulderton.

SEWERAGE AND SEWAGE DISPOSAL.

Burry Port U.D.C. — Mr. A. P. I. Cotterell, M.INST.C.E., has completed the plans of a sewerage scheme for the council.

WATER, GAS, AND ELECTRICITY.

Belfast T.C.—The Tramways and Electricity Committee have been considering the question of the increasing demands on the electricity station, and how these are to be met. The city electrical engineer reported that he estimated the demands upon the station this winter will leave a margin of about 11 per cent on the plant, based on the assumption that the whole of the plant is simultaneously available at its full normal rating. He was not satisfied with the margin, as it should be at least 25 per cent. The chairman suggested that a communication should be addressed to large consumers of electricity, asking them to reduce their lighting as much as possible during the time of the heavy demand upon the station, without prejudice to their receiving the reduced supply of current at the minimum rate in their respective agreements. The committee approved of this suggestion.

Blackburn T.C.—A proposal has been submitted by the Gas Committee for the provision of a tar-distillation plant, at an approximate cost of £5,000.

Kilmarnock T.C.—The manager of the electricity department has been authorised to negotiate for an overhead line extension to Troon for the supply of electricity.

Newport (Mon.) T.C.—The accounts of the electricity and tramways undertaking for the last financial year show a nett profit of £4,115, a deficiency of £993 on electricity being counterbalanced by a profit balance of £5,108 on the tramway service.

Ripon T.C.—The city council at a special meeting recently considered the question of an electric lighting scheme for the city and district, at an estimated cost of £20,000. Objection was taken to the proposed site of the works, which it was proposed to purchase at a cost of £800, and eventually the whole matter was referred to the next meeting.

Sheffield T.C.—The Electric Supply Committee recommend that Sir Alexander Kennedy be asked to advise on a proposal for a new generating station. A proposal has also been submitted by the Finance Consultative Committee for the provision of a tramway depot at the corner of Pickmere-road and Fitzgerald-road, while the building of a sub-station is recommended by the Electric Supply Committee, at an approximate cost, exclusive of the price of the land, of £8,000.

Southampton T.C.—The borough electrical engineer has been instructed to prepare a scheme for the extension of the boilers.

Spenborough U.D.C.—The Gas Committee recommend the installation of a coke washer and breaker at the gasworks.

Stafford T.C.—An intimation has been received that the Local Government Board have declined to sanction a loan of £1,000 for the purchase of land for the extension of the electricity works.

Swansea T.C.—The town council are seeking the sanction of the Local Government Board to a loan for plant extension at the generating station.

MISCELLANEOUS.

Hammersmith B.C.—The council, on the recommendation of the Special Purposes Committee, have adopted a resolution affirming that it is "absolutely essential to adopt the decimal system of coinage, weights, and measures throughout the British Isles."

Kirkwall T.C.—The burgh surveyor, Mr. M. Heddle, has been instructed to repair the fire hose and to obtain additional hose if necessary.

Middlesbrough T.C.—The corporation have granted a second war bonus to their employees, which, it is estimated, will involve a further charge of £3,923 per annum on the rates. Over 1,100 employees will benefit.

Scalby U.D.C.—A scheme has been adopted for the reorganisation of the fire brigade by the provision of the necessary equipment, and the formation of a volunteer body of workers.

Swansea T.C.—A meeting of the joint committees of the corporation has decided to grant a bonus of 10 per cent to all officers in receipt of less than £250 a year, the annual increments to remain.

Warwickshire C.C.—The council have agreed to grant a war bonus of 3s. per week to each of the four inspectors of main roads (all of whom are married men) and 1s. per week for each child under fourteen. The inspectors are also to receive £10 per annum each towards their travelling expenses.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATION FOR LOAN.

Sheffield T.C.—£35,000 for the purchase of twenty-five tramcars.

LOAN SANCTIONED.

St. Ives (Cornwall) T.C.—£1,400 for a harbour improvement scheme.

The War and Contracts.—In the paragraph which appeared under this heading in our last issue, p. 412, the name of the surveyor to the St. Thomas Rural District Council was incorrectly given. Mr. J. S. Madge is the present surveyor to that authority.

Yorkshire Association of Students.—The Yorkshire Association of Students of the Institution of Civil Engineers will hold its first ordinary meeting of the session at the Philosophical Hall, Leeds, on Wednesday next, at 7.30 p.m., when Mr. George A. Hart, M.INST.C.E., sewerage engineer to the corporation of that city, will deliver his presidential address.

The Surveyors' Institution.—The first meeting of the session will be held at 12 Great George-street, S.W., at 5 p.m., on Monday next, when the new president, Mr. George F. Stewart, D.C.L., will give his opening address. Mr. Stewart stands in the exceptional position of being the first member of the Irish branch of the institution to be elected president, and it is hoped that there will be a full attendance to welcome him.

Acquisition of Land Bill.—Mr. W. Edgar Horne's amendment to clause 8 of the Defence of the Realm (Acquisition of Land) Bill was accepted by the House of Commons on the Report stage. By this amendment questions relating to compensation may be referred to referees selected from a panel set up by the Lord Chief Justice, the Master of the Rolls, and the president of the Surveyors' Institution, the precedent of the Finance (1909-10) Act, 1910, as to the tribunal for appeal being followed in this respect.

FOR OTHER ADVERTISEMENTS

See End of Paper.

THE ROTHERHAM RURAL DISTRICT COUNCIL require a Steam Road Roller Driver; must not be eligible for Military Service. A permanency for steady and capable man. Wages £2 per week, living van provided. Apply to R. Bradbury, Imperial-buildings, Rotherham. (3,162)

TWO CLERKS OF WORKS required for Sandling Divisional R.E., Kent. Former experience of R.E. work preferred. Reply, stating qualifications and experience, to Division Officer, Royal Engineers, Saltwood, Hythe. (3,163)

EAST BARNET VALLEY URBAN DISTRICT COUNCIL.

SURVEYOR'S TEMPORARY ASSISTANT.

The Council invites applications from men, ineligible for Military Service, for the position of Surveyor's Temporary Assistant, at a salary at the rate of £100 per annum.

Applicants must have had previous experience in the work of a Municipal Surveyor's Office.

The appointment will be terminable by one calendar month's notice on either side.

Applications, endorsed "Surveyor's Assistant," stating age, experience, present employment, reason why ineligible for Military Service, and what documentary or other evidence can be submitted in support thereof, and accompanied by copies of two recent testimonials, should reach me not later than 4 p.m. on Monday, the 20th instant.

T. A. BUCKLEY,
Clerk to the Council.

Council Offices,
New Barnet.
November 9, 1916. (3,160)

NATIONAL ASSOCIATION OF LOCAL GOVERNMENT OFFICERS.

THE MEMBERSHIP AND FINANCES.

The eleventh annual meeting of the National Council of the National Association of Local Government Officers was held on Saturday last at the City of London Guildhall, Sir Homewood Crawford, the president, occupying the chair. A civic welcome was accorded to the members by the Lord Mayor, Sir C. C. Wakefield, who, in the course of his remarks, observed that it was all-important that the activities of the association should be continued, so that those members of the local government service who were now serving their country should not find on their return that their rights and privileges had been entrenched upon.

The secretary's report showed that the membership roll now stands at 27,943, as compared with 36,094 last year, a decrease which is attributed to the inactivity of several branches. Moving the reception of the report, the president said he thought it was greatly to be regretted that at a time when they ought to be doing their utmost in order to keep the municipal flag flying there should have been some associations which thought it necessary and prudent to cease their activities. A time was coming when it would be necessary for all of them to be more than ever on their guard to protect the rights and privileges of the staffs connected with municipal government. As regarded superannuation, that subject was not mentioned in the report for the obvious reason that the present was not an opportune time for any steps to be taken. The subject was, however, at all time under the consideration of the committee, and he ventured to think, with some confidence, that the work now being done by the municipal staffs of the country would stand them in good stead when the time came to press forward their scheme of national superannuation. In the course of further remarks the president mentioned that careful consideration would have to be given to the question whether the association ought not to have some direct representation in Parliament. Another matter was the position of their finances, and in that connection there was an important suggestion with regard to power being given to the trustees to deal with the Law and Parliamentary Fund. It was absolutely necessary, added Sir Homewood, that some steps should be taken to safeguard the association's interests. In spite, however, of the serious times through which the association was passing, they were really holding their own and making headway.

In the course of the subsequent proceedings, approval was given to proposals for the suspension during the current year of the resolution allocating a proportion of the subscriptions to the Law and Parliamentary Fund and to selling or hypothecating the security now in the names of the trustees as part of that fund to meet outstanding liabilities.

Sir Homewood Crawford was unanimously re-elected president.

EXPERIMENTAL RESEARCH WITH ROAD-MAKING MATERIALS.*

By H. K. BENSON.

Director of Industrial Research, University of Washington.

The great variety of materials somewhat indiscriminately used in the building of roads has suggested the possibility of applying the spirit of scientific research to them in a manner analogous to that by which it is applied to materials used in the manufacturing industries. The practical man often looks with disfavour upon the so-called experiments of science since usually he forgets to learn the real value of the unsuccessful experiment.

The writer well remembers the statement of Dr. Remsen, the great American pioneer chemist, that it is one of the tragedies of science that the failures of scientific research are not recorded. In other words, we often learn more of the basic facts underlying a given problem from what we are unable to accomplish than from the things which actually are done. The failure of a given attempt should not, therefore, be accounted as loss, but rather as a contribution to the total sum of knowledge which has accumulated about a particular subject. If it is true that we are passing through a transitional stage, then every bit of evidence collected and put on record will hasten the passage from the present stage to the final or ideal road of the future.

What do we understand by scientific scrutiny? First there is involved a complete record of every type of road during construction, then a continuous record of inspection during the life of the road, and a final drawing of conclusions as to the good and bad qualities of a given type of construction. This involves an organisation which is not subject to change as personnel, as officials come and go. Next in this programme is an aggressive movement to profit from the advances of science through the adoption of new materials and new methods of construction and their subjection to service tests and record. This requires a willingness to consider road problems with an open mind—to admit that the present materials and methods are transitory. Even in the maintenance of roads it involves the trying out and testing of methods.

Experiments conceived in a knowledge of exact conditions, pursued along exactly defined lines, and concluded with definite results, have inaugurated some of the world's greatest industries. It is not unreasonable to believe that the same procedure will establish for us the means for building the highways upon which great multitudes pass back and forth to exchange commodities and increase the volume of trade.

* From a paper presented at the annual convention of the Washington State Association of County Engineers.

PERSONAL.

Mr. James F. Fay has been appointed engineer to the Edenderry No. 2 Rural District Council.

Mr. T. G. Archibald has been appointed burgh surveyor and sanitary inspector of Huntly until the end of the war.

Mr. H. W. Gladwell, surveyor and sanitary inspector to the Walton-on-the-Naze Urban District Council, has resigned.

Mr. W. J. Hiscox, surveyor, water engineer and inspector of nuisances to the Hay Urban District Council, has been appointed borough engineer of Wilton. Previous to taking up the position at Hay, Mr. Hiscox was at Marlborough for twelve years.

Mr. T. R. Sobey, surveyor for the Southern District under the Liskeard Rural District Council, has had his salary increased to £150 per annum. He has been in the service of the local authority for thirty-four years, and has to keep a horse at his own expense.

Mr. Thomas Shelmerdine, who up to nearly two years ago was the city surveyor of Liverpool, has just furnished his service to the city as consulting land steward and surveyor. When he retired from the position of surveyor, about two years ago, he was appointed consulting land steward and surveyor, and the period of that appointment has now expired. Mr. Shelmerdine entered the municipal service as surveyor in 1871. Previously to that he was with his father in the Leigh estate office.

OBITUARY.

Mr. M. W. Mulvihill, who served for many years under the Government of India, and acted for some time as surveyor to the Listowel Urban District Council, died recently, we regret to state.

Mr. John William Smith, road surveyor to the Partington Rural District Council, died suddenly, we regret to state, on the 1st inst. He was sixty-seven years of age, and leaves a widow, two daughters, and two sons, who are at the Front.

Mr. G. Eaton Shore, borough engineer and surveyor of Crewe, died, we regret to state, on Monday last, after a long illness in his sixty-fourth year. He was appointed to the position in 1882, and had thus held office for a period of thirty-four years. Upon the extension of the borough in 1892 he prepared the plans for the sewering of the new streets taken over, and he was responsible for the plans for the extension of the administrative offices, the town depot, and fire station. Mr. Eaton-Shore's most important achievement was the carrying out of the new sewage disposal works, which were estimated to cost £60,350, but were actually constructed for approximately £49,000.

ROAD MAINTENANCE IN BEDFORDSHIRE.

The details of costs of the 736¾ miles of rural main roads of Bedfordshire during the year ended March 31st last show that a total of £53,323 has been expended, as against a total of £58,846 in the previous year, and that whereas in 1914-15 the average cost per mile was £79 17s. 4d., the figure for 1915-16 was £72 7s. 5d.—a reduction of £7 9s. 11d. per mile. Owing to the receipts from the Road Board falling from £4,401 in the previous year to £1,839, the comparative reduction in cost is only £4 per mile.

This reduction, Mr. F. W. Smart, the county surveyor, points out in his annual report, is consequent upon all works being carried out with the strictest regard to economy, and also, to a larger extent, to the impossibility of obtaining supplies of materials when required.

The north, south, and west district costs have all been reduced, and the only increase is in the east district, where special road works in the locality of a camp have been imperative, and roads which, under normal conditions, have only cost £50 annually have cost approximately £1,000 to maintain during last winter.

Practically nothing but tarred slag-macadam has been used for improved surfacing work, and of a total quantity of 10,388 tons laid down during the year, 9,288 tons were manufactured at the depot, the balance being purchased for use in the south district.

TARRED SLAG COSTS.

The output of tarred slag from the depot plant was 11,584 tons, at a cost of 11s. 2¼d. per ton, as compared with 10s. 9½d. of the previous year. The comparative cost for the same grades of material at Bedford Station, as quoted by merchants, was 14s. 7d. per ton, showing a saving of 3s. 4¾d. The plant continues to give every satisfaction, and in consequence of nothing but dehydrated tar being used, it was necessary to provide a steam boiler and fit up the various tanks with steam coils to facilitate pumping during the winter months. All the work in connection with this installation has been carried out by the depot staff.

SURFACE TARRING.

The surface tarring of the roads has been somewhat curtailed in consequence of the difficulty in obtaining sufficient labour during the summer months, the total quantity of tar used being 37,000 gallons less than the previous year.

DAMAGE TO ROADS.

Many of the principal roads of the county have been considerably damaged by military and heavy motor traffic, especially the roads around Bedford and the Watling street, where the heavy traffic is continuous throughout the year. It was necessary in the case of Watling-street to prepare a scheme for reconstruction and the strengthening of the abutments of several sections, as it is most undesirable, the county surveyor points out, to resurface with tarred slag until the strengthening works have been carried out. These works are now in hand, but it will be several years before the full length is completed, as it is only possible with the present conditions of labour to undertake a small section each year.

DAY WORK TEAM LABOUR.

The cost of this work for the year has been £2,728, or an average of £3 14s. 1d. per mile, as compared with £2,336, or an average of £3 3s. 5d. per mile in the previous year.

MANUAL LABOUR.

The total cost of this work, including culverts and improvements for the year, has been £11,392, or an average of £15 9s. 3d. per mile. The cost in the previous year was £10,985, or an average of £14 18s. 2d. per mile.

Surface Tarring Methods.—An inquiry made by Mr. Burnett Bullock, the surveyor to the Mitcham, Surrey, Urban District Council, as to the methods of surface tarring adopted by other authorities which he thought would probably tar about the same area as Mitcham has elicited replies from forty-three of the officials to whom it was addressed. Of this number twenty-two use machines, seventeen tar by hand, three have adopted the contract system, and one employs both hand and machine.

THE WAR FOR HEALTH.*

By Sir John McCall, M.D.,
Agent-General for Tasmania.

When the war is over and we come to count up our losses we will realise what a valuable thing human life really is. Let us hope this will lead us to value human life more than we have done in the past. We will have another war, but it will not be one for the destruction of human life, but rather one to save it—the war for health.

We will try and move those charged with the government of the country to make laws which stop preventable diseases wrecking the health of the people—more particularly those in our cities, towns and villages, and also to prevent the high rate of mortality among infants, both ante and post natal. We must declare war against ignorance, apathy and criminality. In that war my own profession must take the leading part. Your institution must help us with the material foundations suggested by the profession of its members. The medical profession must bring all its influence to bear on contagious diseases and you yours on sanitary science. However brilliant the plan of campaign, however carefully worked out to the last detail, it will come to naught without the loyal and intelligent co-operation of the rank and file—in a word the people must be educated in all measures they are expected to take to ensure the best results in public health; every citizen should be a sentinel and every mistress of a household an executive officer.

The Health Week inaugurated by the Institution of Sanitary Engineers, and carried out by a committee presided over by the Lord Mayor of London, under the auspices of the Royal Sanitary Institute, must be again revived after the war. Success in war depends on the individual soldier—man power—but it means men organised into companies, brigades, armies, and in many cases it is necessary to have the armies of several countries working in co-ordination. So in the war for health it means that we must have organised man and woman power, in professional societies, educated masses and co-ordinate efforts to secure sound administration of perfect Health Acts. The battle for health must include the strictest administration of the various Health Acts, and the amendment of these Acts. Slums should be abolished, as is being done in many large cities; where possible garden cities should be established and country life should be secured to all workers whose families require it for the health of their families.

To take charge of the health of the whole people of the Empire and make their health a duty of the State so far as is necessary means that an enormous additional sum of money will have to be found from public funds. It is not necessary for me to indicate how this money shall be raised, but I do say it must be found, and that it will repay the State many times over by the saving of human lives that will be effected; that it is necessary for the Empire and for the world that we should exercise greater care in saving lives should be clear to all at a time when the most valuable lives of our people have to be sacrificed in the defence of our Empire.

A Road Roller Attendant and His Notice.—At the Liskeard Rural District Council recently Mr. T. Shovel reported on behalf of the Callington Committee that a case had been before them of a man employed in attending the steam roller, who had intimated his intention of leaving their employment, without giving the proper legal notice. Three weeks ago he told Mr. Truscott (the surveyor) that he was going to give notice, but none had been received, and on Friday he told Mr. Truscott that he was leaving after Saturday, as he had obtained more lucrative employment. The committee maintained that they should receive the usual month's notice, but were quite willing for him to leave within a month if Mr. Truscott could get a suitable man in his place. Replying to a question, Mr. J. R. Sobey (surveyor for the southern district) said it was usual for there to be a month's notice on either side. He could not remember a man leaving their service without giving the proper notice. By a large majority the surveyor was instructed to withhold four of the five weeks' wages due to the man that day, if he still stated that he would not come to work on Monday, but that the money be paid if he remained at work until Mr. Truscott found a substitute.

* Extracts from an address delivered last night before the Institution of Sanitary Engineers,

State Supervision of Sewage Works Construction and Operation in America.

[The Committee on Sewage Works Operation and Analytical Methods of the Sanitary Engineering Section of the American Public Health Association have already made two reports relative to the principles of operation and recommending analytical tests for use in connection with sewage treatment works, and in a third report issued on October 26th they review certain features of these prior reports before proceeding with the matter of State supervision over sewage works operation. The committee observe *inter alia* that, owing to the many forces of Nature utilised in sewage treatment and the heterogeneous composition of sewage, it is self-evident that the operation of sewage treatment works cannot be made automatic, but requires observation and supervision by trained, skilled operators, at more or less frequent intervals, in order to accomplish the purpose for which the plant is installed. The committee's table of analytical tests submitted in 1914 is referred to, and their use, when possible, is again urgently recommended. Below are some extracts from the report.]

It is recognised that in a great number of small works, the purpose of which is primarily to prevent the creation of nuisance, only the simplest tests are practical under present conditions, and it is recommended that in such cases samples of the final effluent be incubated at room temperature with methylene blue, and record kept of the number of days the samples retain their blue colour. The required degree of stability depends largely upon the conditions in the receiving body of water. Where stability is demanded, on account of the dilution afforded being small, the samples of the effluent should retain their blue colour at least ten or twelve days at room temperature, or five or six days if incubated at 37 deg. Cent.

Attention is again called to the importance in selecting analytical tests for sewage works to the fact that changes in methods of operation and records for comparison are the primary purposes of this work, and the acquirement of mere academic information, while interesting, is energy wasted, which could better be expended in other directions.

Considering the number of municipal sewage treatment works in America, it is surprising to learn how few are subject to laboratory control, but the newer plants are being so equipped, and show the growing appreciation of the economy of proper operation.

Another very noticeable defect in the design of a large percentage of works is the complete absence of any method of determining the amount of sewage treated. This is of prime importance to successful operation, for otherwise retention in tanks and rates on filters are indeterminate, and it is difficult, if not impossible, to know whether unsatisfactory results are due to overloading of the parts of the works or to improper methods of operation.

Where fall is available, a weir, preferably with an automatic recording device, is a simple and inexpensive method to use. Where the sewage has to be pumped, the Venturi meter has proved successful. In works having a dosing tank, an approximation of the rate of flow may be obtained by the use of a float-actuated counter, which indicates the number of discharges of the dosing tank. In the case of heavy flow, when a considerable amount of sewage runs in while the tank is discharging, the total discharge may be obtained by the following formula:—

$$D = \left(n + \frac{ne}{f}\right)v,$$

in which D = total discharge in unit of time, n = number of discharges in the same unit of time, e = time of emptying; f = time of filling; v = volume of dosing tank. When e is very small as compared with f, then $\frac{ne}{f}$ may be omitted, and $D = nv$.

NEED FOR EXPERT SUPERVISION.

Your committee, in its report last year, called attention to the fact that "as the great majority of sewage treatment plants in America are small, and frequently widely separated, it is apparent that the needed expert supervision cannot be obtained locally, and that efficiency of operation can only be obtained through some central authority."

In some States associations of those interested, consisting of sewage works superintendents, State engineers and others, are now being formed to hold meetings periodically to discuss practical questions on operation. The formation of such bodies and their frequent gatherings are highly recommended by your committee. Such meetings stimulate interest and are sources of information to many. One of our correspondents stated: "We suffer greatly in this State because of unskilful operation of sewage treatment plants. Some of our plants receive almost no attention. In other cases services are employed, but they are either inadequate or inefficient."

The State boards of health are the logical bodies to provide this supervision, due to their uniform relation to all the municipalities in each State, and with similar boards in adjacent States.

Furthermore, the sanitary disposal of sewage is a matter generally affecting the commonwealth more than the individual community. The State is interested in requiring that sewage treatment works accomplish the best results possible, while the separate communities are naturally anxious that the works shall meet the requirements at the minimum expense for operation, additions and renewals.

It may be assumed, therefore, as an axiomatic statement, that, for the good of the commonwealth, the municipalities and private owners, any procedure which will accomplish the above conditions is worthy of careful study and adoption.

During the past year your committee has been corresponding with the sanitary engineers of the various State boards and departments of health to obtain their views on our last year's report and their present and proposed procedure relative to control over the installation and operation of sewage treatment works.

For the purpose of this report we have divided the forty-eight State boards of health in the United States into three groups, as follows:—

(*a*) Those States whose boards of health either have no engineer upon their staff, or have no specific legislation giving them control over the disposal of sewage, or have so few sewage treatment works under their jurisdiction that the subject is negligible. These twenty-four States in 1910 had a population of over 24,250,000, or 26 per cent of the total population of the United States.

(*b*) Those States whose boards of health have an engineer or other officer charged with supervision over disposal of sewage, but whose legal powers are limited and the number of sewage treatment works are small. The officers of this group of States have all signified their willingness to co-operate with your committee and have furnished valuable data. These nine States in 1910 had a population of 12,753,000, or 14 per cent of the total population of the United States.

(*c*) The remaining fifteen States have boards of health with engineering divisions, and either have legal authority or otherwise exercise control over the disposal of sewage and operation of sewage treatment works. The 1910 population in these States was about 54,000,000, or 60 per cent of the total population of the United States.

Generally, sewerage plans must be approved before construction and supervision, inspection and analyses are made, and in some reports of operation are made to the State Board of Health.

The approval of plans for sewerage projects by the commonwealth is of great advantage to the community, institution or individual about to expend funds for the construction of sewers or sewage treatment works, for it assures the carrying out of the work along comprehensive lines, which ultimately is economy, prevents the construction of ill or improperly designed works, and tends to uniformity of practice throughout the State.

The supervision over operation and inspection of sewage treatment works by the State in cases where works are efficiently operated becomes an endorsement more than anything else. In the case of the smaller works, which are frequently placed in charge of untrained and technically deficient operators, State supervision not only protects the commonwealth, but

makes possible the performance of the functions of the works for which they were designed and the funds invested.

Commonwealths representing more than half the population of the United States have given their State boards of health these powers, but at the present time only in Massachusetts, Pennsylvania and Texas is the operation of the sewage treatment works regularly reported to the State officials. Several other States are preparing to inaugurate this means of exercising supervision, and your committee therefore deems the time ripe for a thorough discussion of these matters, in the hope that from it those State engineers who are planning to put such a system into practice may obtain helpful suggestions from the experience of others, and that State boards of health not now clothed with sufficient powers to protect and aid their citizens properly may succeed in obtaining legislation to that end.

SUBMISSION OF SEWERAGE PLANS FOR STATE APPROVAL.

Prior to contracts being made for the construction of sewerage works (sewers, pumping stations, or treatment works), plans of the same should be submitted to the State board or department of health for examination, and, if satisfactory, approved.

The examination should include a determination of conformity to a comprehensive plan proper for future conditions, even though in many cases it may not be necessary to construct, at first, any more than part of the sewer system and only provide for preliminary treatment of sewage.

The adoption of a comprehensive plan, if only in outline, assures the future utilisation of each part of the entire project as built.

The examination of the plans submitted should also include the fitness of the design and types of treatment to produce the quality of effluent demanded by the conditions of the receiving body of water. For example—it is unjust and a waste of public funds to approve, without comment, a complete treatment works for sewage to be discharged into a receiving body of water where neither the public health nor æsthetic conditions require at the present time more than preliminary treatment.

In the interest of economy of both public and private funds, it is most desirable to obtain co-operation between designing engineers and the State officials, especially during the preparation of the preliminary plans. For example—take the case where, in accordance with an order of the State officers, the engineers of a town are beginning the studies needed to prepare the preliminary plans; if, by conference between the officers of the State and of the town, a decision could be reached that, in order to protect shell-fish beds, clarification and disinfection only would be required, the designing engineers, at the minimum expense, could select types of processes to meet only these requirements, rather than make studies for submission to the State in ignorance of the policy adopted by the commonwealth for that stream or part of the stream.

This co-operation between the separate communities and the commonwealth also avoids delays in final approval, and there would be greater assurance of approval without requirement of changes in the final plans, which cause delay in construction and needless expense to the applicants.

The plans as approved should be filed with the State and no material deviation in design permitted without State approval.

Subsequent additions or changes in construction should likewise be approved and filed.

In addition to the obvious advantages to all concerned, this procedure provides the State with correct plans of all the sewerage works within its jurisdiction which are needed for proper supervision of operation.

SUPERVISION OF OPERATION.

Upon completion of the construction of sewage treatment works it very frequently happens that the operation is entrusted to persons entirely unfamiliar with the intent and purpose of the designer. It is particularly important that early operation, where adjustment of parts must be made to meet unanticipated conditions, should be entrusted to either the designer or some engineer familiar with all the intricacies of operation. This provision can be met by a requirement in the permit of approval issued by the State for the construction of the works.

Generally, only cities at the present time can afford to provide expert operators for sewage works, and the percentages given strongly confirm the statements in last year's report relative to the need for State supervision over operation.

In justice to the larger cities, it should be borne in mind, however, that most of the large cities of this country are situated upon large rivers or great bodies of quiescent water, so that up to a short time ago the necessity for sewage treatment was not fully realised. Many of these municipalities have spent great sums for sewer systems with but little thought of the question of sewage treatment, so that the interception of the sewage and its transportation to treatment works, together with changes necessary in the existing system, requires detailed studies and large expenditures for preliminary work in most cases before the construction of the treatment works can be undertaken. Many of these cities are now engaged in this preliminary work.

This supervision should include inspection of the works, analyses of sewage and effluents, and examination of records of operation. With these data the State officials can advise those in charge of the works how to operate them to obtain the best results.

The foregoing report is signed by Messrs. F. E. Daniels, C. A. Emerson, junr., C. B. Hoover, Richard Messer, and W. L. Stevenson (chairman of committee).

WAR-TIME ROAD DAMAGE.

LOCAL AUTHORITIES' DIFFICULTIES.

At the last meeting of the Easingwold Rural District Council a communication was read from the Road Board, in reply to a resolution from the Helmsley Council, which the Easingwold authority supported at the last meeting, stating that the Road Board had no power to make grants towards the repairing of roads damaged by timber leading unless the extraordinary traffic was caused by or on behalf of a Government department. Alderman Hawking said the position was a difficult one, but it was one which sooner or later would have to be defined by the State. The wood which was being led over those roads was undoubtedly being requisitioned for State purposes, and a great amount of damage was being caused to the roads. It would, in the end, take thousands of pounds to repair them. He advised the council to leave the matter alone for the present. The chairman said it would not have done harm to have pointed out to the Road Board that the timber was for State purposes. It was agreed to adopt Alderman Hawking's suggestion.

In the course of the last meeting of the Sleaford Rural District Council the condition of the roads leading to Cranwell was reported to be bad, but that nothing definite could be obtained from the Road Board as to that authority bearing the cost for the extraodinary traffic. It was feared that a supplementary rate would have to be levied over the district. A proposal was made that Mr. Royds, M.P., should be asked to raise the question in the House of Commons, but ultimately it was agreed to write to the Local Government Board.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have, we are informed by the secretary, Mr. Alfred R. Potter, been arranged as under:—

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., A.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Prof. S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffries (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act, with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

CONCRETE INSTITUTE.

PROGRAMME OF SESSION 1916-17.

Mr. F. E. Wentworth-Sheilds, M.INST.C.E., will on Thursday, the 23rd inst., deliver his presidential address before the members of the Concrete Institute.

Other fixtures for the session are as under:

December 21st.—Prof. Henry Adams, M.INST.C.E., on "Pile Driving and the Supporting Power of Piles."

January 25th.—Mr. C. R. Peers, chief inspector of ancient monuments, H.M. Office of Works, on "The Care of Ancient Monuments."

February 22nd.—Mr. Robert N. Sinclair on "Southampton Docks, Reconstructing of an Old Dry Dock."

March 22nd.—Mr. W. Cleaver on "The Rational Design of Reinforced Concrete Wharves and Jetties, with particular reference to those for Wet Docks, having a Permanent Water Level."

April 26th.—Mr. S. Bylander on "Secondary Stresses in Structural Steel."

The meetings will be held at Denison House, 296 Vauxhall Bridge-road, Westminster.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SURVEYOR OF SEWERS.—November 11th.—Commissioners of Sewers for the County of Lincoln. £250 per annum.—Mr. G. Beaumont Walker, clerk of sewers, Clerk's Office, Spilsby.

TEMPORARY ASSISTANT SANITARY INSPECTOR.—November 13th.—Maidstone Rural District Council. £2 per week.—Mr. Thos. A. Busbridge, surveyor and inspector, Council Offices, King-street, Maidstone.

ASSISTANT TO COUNTY SURVEYOR.—November 13th.—West Suffolk County Council.—Mr. W. Lionel Jenkins, county surveyor, Shire Hall, Bury St. Edmunds.

SHORTHAND TYPIST (Male or Female).—November 14th.—Barking Town Urban District Council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

ENGINEERING ASSISTANT.—November 14th.—Barking Town Urban District Council.—Mr. R. A. Lay, acting surveyor, Public Offices, Barking.

BOROUGH SURVEYOR'S TEMPORARY ASSISTANT.—November 15th.—Corporation of Wigan. £130 a year.—Mr. A. T. Gooseman, borough engineer and surveyor, King-street West, Wigan.

MAIN ROAD DISTRICT SURVEYOR.—November 16th.—Derbyshire County Council. £230 per annum.—Mr. J. W. Horton, county surveyor, County Offices, Derby.

ROLLER DRIVERS.—November 20th.—Hendon Urban District Council. £2 2s. per week.—The Surveyor, Council Offices, Hendon, N.W.

SURVEYOR'S ASSISTANT.—Wells Rural District Council.—Mr. E. H. Padfield, surveyor, Westholme, Pilton, Shepton Mallet.

SURVEYOR'S CLERK.—For the War Department. Commanding Royal Engineer, North Aldershot.

FOREMAN PLUMBER.—Sheffield Corporation Waterworks.—Mr. William Terrey, general manager, Town Hall, Sheffield.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

GRIMSBY.—November 13th.—For converting the municipal hall into a dispensary and children's clinic, for the corporation.—Mr. H. G. Whyatt, borough engineer and surveyor, Municipal Buildings, 170 Victoria-street, Grimsby.

BELFAST.—November 20th.—For building an open-air school at Whiteabbey, for the corporation.—City Surveyor, City Hall, Belfast.

MANCHESTER.—November 22nd.—For repairs to a building, for the Improvement and Buildings Committee. City Architect, Town Hall.

Engineering: Iron and Steel.

ALDERSHOT.—November 14th.—For the supply of 3-b.h.p. gas engine, with water-cooling tank, gas bag, and air box, for the urban district council.—Mr. D. L. Griffiths, clerk.

MANCHESTER.—November 14th.—For the supply and erection of a steam disinfector, for the Tramways Committee.—Mr. J. M. McElroy, general manager, Corporation Tramways, 55 Piccadilly, Manchester.

ROTHERHAM.—November 16th.—For the supply of six electric double-deck top covered cars, for the Tramways Committee.—Mr. E. Cross, general manager, Tramways Depot, Rotherham.

DUNFERMLINE.—November 16th—December 5th.—For supplying and laying 6 miles of cast-iron pipes and incidental works, for the corporation. Messrs. Crouch, Hogg & Easton, 14 Blythwood-square, Glasgow.

CARDIFF.—November 18th.—For the provision and erection of a hot-water boiler, for the Board of Guardians.—Mr. S. W. Allen, consulting engineer.

WALLASEY.—November 21st.—For the supply and erection of 25 per cent liquor concentrating plant and connections at the gasworks, for the corporation.—The Gas Engineer, Limekiln-lane, Seacombe, Wallasey.

LEYLAND.—November 27th.—For laying cast-iron water main, hydrants, and appurtenant works, for the urban district council.—Mr. C. J. Lomax, engineer, 37 Cross-street, Manchester.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

DURBAN.—January 3rd.—For the supply of a 3,000-k.w. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Ivetell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

CARMARTHEN.—For the supply of 240 lin. yds. of good, second-hand or new steel bridge rails and sleepers, for the county council.—Mr. R. W. Jones, county surveyor, Carmarthen.

STALYBRIDGE.—For the supply of water-tube boilers, mechanical stokers, and cooling towers, for the corporation.—Mr. R. Blackmore, engineer-in-chief, Generating Station, Stalybridge.

Roads.

ALDERSHOT.—November 14th.—For the supply of 1,300 tons of Devon, Clee Hill, or Welsh basalt, for the urban district council.—Mr. D. L. Griffiths, clerk.

ILKLEY.—November 14th.—For the supply of 500 tons of granite, 500 tons of whinstone, 500 tons of limestone, and 500 tons of tar-macadam.—Mr. T. H. Smith, surveyor, Town Hall.

CARSHALTON.—November 21st.—For the supply of 275 cub. yds. of 1½-in. granite, either Clee Hill, Quenast, Penmaenmawr, or Guernsey, and the hire of steam road roller and scarifier, for the urban district council.—Mr. W. Willis Gale, surveyor, District Council Offices, The Square, Carshalton.

ISLE OF WIGHT.—November 21st.—For the supply of road materials and team labour, for the rural district council.—District Council Offices, 30 Pyle-street, Newport, I.W.

WEST HARTLEPOOL.—November 22nd.—For the supply of Yorkshire and concrete kerbstone, flags, scoriæ and whinstone channel blocks and paving setts, hand, machine, and unbroken whinstone, pitch, tar, and lime, for the corporation.—Mr. N. F. Dennis, borough engineer and surveyor, Town Hall.

WARWICKSHIRE. — November 24th. — For the supply of road material (broken and unbroken), and tarred macadam, for the county council.—Mr. John Willmot, county surveyor, 6 Waterloo-street, Birmingham.

CAMBRIDGESHIRE. — November 25th.—For the supply of broken granite, basalt, slag, and tarred macadam, for the county council.—Mr. H. H. Dunn, acting county surveyor, County Hall, Cambridge.

CARMARTHEN.—November 25th.—For the supply of road materials and haulage, for the county council. — Mr. R. W. Jones, County Offices, Carmarthen.

CAERPHILLY.—For the supply of 400 tons of granite metalling and chippings, for the urban district council.—Mr. T. H. Richards, surveyor, Council Offices, Caerphilly.

WEST SUSSEX.—For the immediate supply of 2,000 tons or thereabouts of 2½-in. broken granite, and 750 tons of best quality 2½-in. broken Mendip limestone, for the county council.—Mr. H. W. Bowen, county surveyor, 23 North-street, Horsham.

Stores.

BRISTOL.—November 13th.—For the supply of cement, drain pipes, castings, ironmongery, paints, brushes, bass brooms, and motor rotary brushes (refilling), for the corporation.—City Engineer, 63 Queen-square, Bristol.

CHATHAM.—November 15th.—For the supply of Aylesford gravel, sand, Thames ballast, crushed ragstone, Portland cement, sewer boots, stoneware drain pipes, sewer ironwork, disinfectants, brooms, brushes, picks, shovels, and ironmongery, for the corporation. —Borough Surveyor, Town Hall.

WEST HARTLEPOOL.—November 23rd.—For the supply of kerbstone, flags, channel blocks, paving setts, whinstone, pitch and tar, lime, earthenware sewer pipes, metal castings, cement, disinfectants, and cartage, for the corporation.—Mr. N. F. Dennis, borough engineer and surveyor.

FELLING.—November 25th.—For the supply of macadam, Heworth freestone kerb, setts, whinstone kerb and setts, Portland cement, shovels, brooms, sanitary pipes, and cartage, for the urban district council.—The Surveyor, Council Buildings, Felling-on-Tyne.

Miscellaneous.

RHONDDA.—November 14th.—For the supply of bricks, for the urban district council.—Mr. E. Hazledine Barber, engineer and surveyor, Council Offices, Pentre, Rhondda.

DALTON-IN-FURNESS.—November 18th.—For the supply of about 1,000 Staffordshire tile grave indicators, for the urban district council. — Mr. W. Richardson, surveyor, Town Hall, Dalton-in-Furness.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BEACONSFIELD.—For the supply of 1,000 tons of 2½-in. and 1½-in. broken granite, for the urban district council.—Mr. H. T. Smith, surveyor: -

	Per ton. s. d.
Brookes, Limited, London, S.W.	17 6
Johnston Brothers, London, E.C. (Ceiriog grey)	17 5
Groby Granite Company, Limited, Leicester	17 0
Johnston Brothers, London, E.C. (Breidden Hill)	16 9
Johnston Brothers, London, E.C. (Blodwell blue)	16 9
Whitwick Granite Company, Limited, Leicester	16 6
L. Summerfield, Limited, London	16 0
Rowley Regis Granite Quarries, Limited, Birmingham	15 11
Enderby and Stoney Stanton Granite Company, Limited, Leicester (2½ in.)	15 8
Mountsorrel Granite Company, Limited, Loughborough	15 6
Arenig Granite Company, Limited, Shrewsbury (2½ in.)	15 6
Enderby and Stoney Stanton Granite Company, Limited, Leicester (1½ in.)	15 5
W. L. Ireland, Atherstone	15 3
Arenig Granite Company, Limited, Shrewsbury (1½ in.)	14 6
Abdon Clee Stone Quarries Company, Bridgnorth, Salop	14 3
H. Cooper & Co., London, E.C.	14 3
Field & Mackay, Bitterley, near Ludlow *	14 3

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

10.—Town Planning Institute: Mr. T. Alwyn Lloyd on "Town Planning in Wales, with Special Reference in Development of Hilly Sites."
13.—Surveyors' Institution: President's opening address. 5 p.m.
14.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
21.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
23.—Concrete Institute: Mr. F. E. Wentworth-Sheilds delivers his presidential address. 5.30 p.m.
28.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

DECEMBER.

5.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
8.—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.
12.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
21.—Concrete Institute: Prof. Henry Adams on "Pile Driving and the Supporting Power of Piles." 5.30 p.m.

A Glossary of Road Terms. By H. Percy Boulnois, M.Inst.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he has made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

APPOINTMENTS OPEN.

DERBYSHIRE COUNTY COUNCIL.
MAIN ROAD DISTRICT SURVEYOR.

Wanted, at once, for the period of the war, Temporary District Surveyor, ineligible for military service, to take charge of Main Roads in a district under direct maintenance.

Salary at the rate of £230 per annum, to include provision and maintenance of motor bicycle. An additional allowance of £10 per annum will be made for provision of office.

Particulars of duties, &c., and Form of Application can be obtained from the undersigned, to whom applications must be sent on the special Form not later than Thursday, the 16th November.

J. W. HORTON,
County Surveyor.

County Offices, Derby.
October 31, 1916. (3,151)

SHEFFIELD CORPORATION WATER-WORKS.
FOREMAN PLUMBER.

Wanted, a qualified and experienced Waterworks Plumber to superintend the work of the Plumbing Department.

Applicants must have held similar position, be accustomed to control workmen, and ineligible for Military Service.

Apply by letter, stating age, experience, and wages required.

WILLIAM TERREY,
General Manager.

Town Hall,
Sheffield.
November 7, 1916. (3,159)

ROAD AND GENERAL FOREMAN, over military age; good cyclist. Beverley Rural District Council. 36s. per week. Testimonials, &c., to E. Picker, Surveyor. (3,143)

WANTED, a Surveyor's Clerk; preference given to one acquainted with the War Department Schedule of Prices. Apply—

COMMANDING ROYAL ENGINEER,
North Aldershot. (3,158)

The Surveyor

And Municipal and County Engineer.

Vol. L. NOVEMBER 17, 1916. No. 1,296.

Minutes of Proceedings.

Sanitary Inspectors and the Public Health.

The important part that has been played by sanitary inspectors in the protection of the public health has in the past received but scant recognition by the public at large. The importance of their work, which extends far beyond the mere suppression of nuisances, was emphasised in the excellent paper which Mr. T. G. Dee read at the recent Cardiff conference of the Sanitary Inspectors' Association. The history of public health legislation in this country shows that the sanitary inspector was intended to have a definite place in the administrative machine. That the data contained from the accumulated experience of medical practitioners was the principal factor in defining the earliest modern sanitary statutes is well shown by the titles of the "Nuisances Removal and Diseases Prevention Act" of 1848, and the amending Act of 1849, while the consolidation and amendment of these statutes in 1855, under the title of "The Diseases Prevention Act" and "The Nuisances Removal Act for England," definitely and clearly separated the duty of dealing with disease from those connected with the abatement of nuisances. These statutes brought into existence a statutory complainant and executive officer, denominated sanitary inspector. The Nuisances Removal Act provided that all local authorities throughout England should appoint sanitary inspectors as might be required—*i.e.*, several, one, or in conjunction with other authorities, one, as the circumstances of the various districts warranted. The duty of a sanitary inspector thus appointed consisted (*a*) in ascertaining the existence of specified nuisances; (*b*) reporting them to the local authority; and (*c*) taking such further action therein as the said local authority desired. At various intervals during the twenty years following the passing of these Acts many statutes were enacted by which the powers and duties of the local authorities were enlarged with respect to both disease and environment, but it was not until 1875 that any variation was made in the law for appointing medical officers of health and sanitary inspectors. The well-known Public Health Act of 1875 was not passed because the statutes of 1855 which created the statutory office of sanitary inspector were found to be defective, but because of the necessity for the consolidation of the numerous statutes, and so far as the officers are concerned this was attained by sec. 189, which enacts that "every urban authority shall . . . appoint fit and proper persons to be medical officer of health, surveyor, inspector of nuisances, clerk, and treasurer." It was thus carefully indicated in a public health statute what is the relative value from a public health point of view, and importance of the various officials—viz., a duly qualified medical practitioner to watch the whole of the conditions affecting the health of the inhabitants and to advise the local authority thereon; a surveyor to carry out the public work required to maintain health; an inspector of nuisances to report to the local authority insanitary conditions, and to carry out all proceedings the local authority deem necessary therein, including legal proceedings; a clerk to record the authorities' proceedings; and a treasurer to deal with the financial matters essential for the public health. Each of these officials in his own sphere has most important duties to perform, and that of the sanitary inspector is of prime importance, inasmuch as it is his business to secure improved environment for the mass of the population.

As Mr. Dee pointed out, the study of the science of life shows that all organisms, according to their own innate and differentiating power, act upon their environment, and that both past and present environment have an enormous influence in the modification of the organism, a continuous and powerful reaction. A human being whose environment nullifies our efforts to improve should not necessarily be considered vile because of our failure; the environment should be changed. We must devise a method of solving this problem and counteracting that which we lazily call vice. The improvement of the environment of the fit and the less fit will improve the organism—Nature looks after that—but if the environment becomes universally bad, the unfit will overrun the earth. When down to the bed-rock the deterioration of our people is due to bad domestic environment. To improve this environment is the peculiar task of the sanitary inspector.

* * *

The Instability of Dams.

If a complete record of the failures which have occurred in dams were prepared it would form very interesting reading, and after the study of such a record the reader would begin to wonder whether any dam should be regarded as a permanent structure unless it is kept under constant observation with suitable maintenance. It is a comparatively simple matter to dam a stream. If the flow of water is obstructed the level will rapidly rise, with the result that a lake is made in a very short time. This is at once striking to the eye and generally impressive. However, it does not follow that water may not be finding its way through, under or round the dam, and slowly but surely undermining it or weakening it. The simplicity of the work of erecting a dam of this character is the reason why we constantly hear of failures, particularly in America. Much has been said recently as to the importance of dam foundations, but a dam built upon the best foundations may fail from a variety of causes. An earthwork dam may become charged with water on the down-stream side, and slip merely as the result of the drainage from the hill sides at the ends. Seepage round the ends may and often does occur, owing to percolation of water into the sides and bottom of the reservoir at points far removed from

the dam. There are cases of earthwork dams with puddled-clay linings, or cores, which are perfectly tight, where seepage may be observed on the valley banks below the dam owing to such causes. To prevent such percolation entirely is extremely difficult, and it is evident that under certain conditions seepage of this kind is likely in time to produce trouble. Our New York contemporary *Engineering Record* records an interesting case in which separate reports were made by different engineers as to the best means of preventing the escape of water from Cedar reservoir at Seattle. One plan suggested was that of introducing fine clay to form a sediment, and thus sealing the floor. Another method suggested was that of lining the reservoir area with a mixture of sand, gravel and asphaltic oil. The city engineer, Mr. Dimock, after taking the reports of the consulting engineers into consideration, advised as the initial step the clearing of the reservoir site, the cutting down of the banks, and the sluicing in of clay. If this failed, he proposed to cover a portion of the area with the asphaltic lining.

Here we see a good instance of the troubles which beset those who build dams. One may wish Mr. Dimock every success in his efforts, but his difficulties, typical of those with which many of his professional brethren have to contend, are great, and it would not be surprising to hear at some future date that the whole area of the reservoir had to be lined. In cases like our own London reservoirs, where a complete ring is made round an area on which water is to be stored, the problem is much simpler. There it is only necessary to carry down the impervious puddle wall to a sufficient depth in the solid clay—there is no chance of leakage round the ends of a dam which is continuous. Assuming that the water leaks round the ends of the Cedar dam and not underneath it, one may ask whether an extension of the watertight portion into the hill sides might not have been worthy of consideration. If, on the other hand, the seepage takes place under the dam, one may ask whether the watertight portion should not have been deepened. The same problem, however, is always recurring, and the great difficulties of dam construction should not be overlooked by those who set out lightly to design such works.

* * *

Domestic Heating.

At the last meeting of the Society of Engineers the subject under discussion was the heating and ventilating of dwelling-houses, introduced by a very suggestive paper by Mr. C. T. A. Hanssen. The problem of domestic heating and ventilation in this country is rendered infinitely more complex owing to our system of living in separate small houses, which are often very badly constructed, and also to our adherence to the open fire. Mr. Hanssen dealt first with ventilation, and pointed out that efficiency can only be secured first, by causing the air to enter a room in such a way that it is not felt as a draught; and secondly, by distributing the entering air over the whole room so that it does not pass in and out as a narrow column, but really replaces the vitiated atmosphere. To endeavour to attain these results by the use of open windows and fires is at once stupid, clumsy, and expensive. The problem can really only be properly solved by means of some device which will enable the new air entering a room to be introduced at the inside temperature. Mr. Hanssen looks forward to the time when there will be such an abundant supply of cheap electric power that it will be possible to work a small fan at a cost of about 1½d. a day. As regards heating, there can be no doubt that the use of the open coal fire is attended by many serious disadvantages. Indeed, it may fairly be said that it combines a maximum amount of domestic drudgery and dirt with a minimum of heating efficiency. The first necessity for improvement in our heating methods is to devise some form of apparatus acceptable to the tastes and habits of the British public that will produce a cheerful and pleasant heat without allowing four-fifths of the heating value of the fuel to go up the chimney. The Continental system of central heating is unfortunately not adaptable to the small separate houses in which the greater part of the population of this country dwells. But in Mr. Hanssen's view it is possible to prevent so much of the heat generated by our open fires from being dissipated to the outside air. For this purpose he suggests much greater attention to the insulation of windows and outside walls, the former by means of double frames and the latter by a lining of slag wool. Of course, a good deal can be done by structural improvement of this kind; but the Englishman is very conservative in his habits, and until tenants can be persuaded that the increased rents necessitated by structural perfection are more than saved in decreased expenditure and greater domestic comfort we are afraid they will be much inclined to stick to old-fashioned methods.

* * *

The Obstructive Tramcar.

In the first of his series of lectures at University College, Gower-street, W.C., on "The Town Planning of Greater London after the War," Prof. S. D. Adshead made some striking observations with regard to the relative uses of motor 'buses and trams. "For my own part," he said, "and I share the views of all drivers of real road traffic, I would like to see the trams swept entirely off the roads." Prof. Adshead's opinion is that, had the London County Council had the foresight to anticipate the motor 'buses, and had they invested their £11,000,000 in inaugurating and improving a suburban electric railway system, in improving road surfaces, and in encouraging the motor 'bus instead of putting their money into trams, London would have been better off to-day. Trams, he went on, were exceedingly obstructive, and with motor traffic rapidly increasing were becoming more so every day. They were inelastic as regarded route, and very expensive to install. "The right use of the tram," added the lecturer, "is as a light railway on a separate track, and so arranged it is quicker than a 'bus, and may have a 30-mile speed limit, only entering main roads for short distances to set down passengers at important points." Convincing arguments can no doubt be adduced in favour of this view, but, so far as London is concerned, we have unfortunately to take things as they are. With the development of Greater London we shall probably find that the idea of a speedway, or separate track for fast-moving traffic, will be recognised. This should not be confined to a tramway or light railway track, but should also be designed to accommodate motor omnibuses and fast-moving traffic of all kinds. If some such device be not adopted the cost of road maintenance, already serious enough, will in a very short time amount to a really alarming figure. The argument is sometimes used that tramways help to regulate traffic, though at points they do much to disorganise it. For our part, we think that there is less danger in crossing a road on which trams run than one in which the traffic is almost wholly motor 'buses and taxis, although this is a question upon which there will probably always be differences of opinion.

* * *

Bognor Council and the Motor 'Bus.

We notice that the Bognor Urban District Council have received a communication from the Southdown Motor 'Bus Company intimating that, owing to the charge of 3d. per 'bus-mile imposed upon them by the road authority, they were compelled to withdraw the

service. It was admitted by most of the speakers at the council meeting that the charge made was prohibitive, and we confess that we find it difficult to disagree with this view. The answer by those who favoured the action of the council was that heavy bus traffic ruined the roads, and that it caused as much damage as it was called upon to pay for. It may be stated that the buses run a journey of 26 miles from Bognor to Portsmouth, and it is therefore evident that the company have to pay 13s. for each journey. It being tacitly admitted that the charge is prohibitive, there would appear to be little further to be said. The council have frankly adopted a policy which would have the effect of driving this particular class of traffic off their roads, and there the matter would seem to rest. But there are more sides to the question than this to the obstructive one. There is, for example, the argument of public convenience, and with respect to this we note that it was stated and not denied that the service met a public need. The public obviously have rights in the user of the roads, whose maintenance they pay for, which cannot or ought not to be overridden in this somewhat drastic fashion. Yet again it might be urged that, while Parliament has conferred the right upon public authorities of imposing a charge upon bus companies to meet the cost of the upkeep of the roads, it was never contemplated that the charges would be made so high as to be prohibitive of bus traffic altogether. It might even be contended that such prohibition is bad from the engineering point of view, for it would be little use of the road engineer applying his skill to the highest form of road construction if the roads are not to be subjected to the supreme test of heavy traffic, a test which enables him to modify and correct his practice. It is manifest that all forms of road traffic must be considered from the standpoint of their public importance and necessity, and also that a public authority should hesitate before it exercised its rights in such a manner as to exclude the factor of fair wear and tear.

* * *

Architectural Association Active Service Committee.

A year has passed since this committee issued their first report. The committee's work consists in sending necessities and extra comforts to men connected with the architectural and surveying professions who are serving with the Colours, and in looking after the wives and dependents of the mechanics who have been recruited from the building trades through the A.A. War Service Bureau. Since October, 1915, this work has been carried on without intermission, and 1,471 parcels of comforts and literature have been despatched to men in France, Flanders, Egypt, Macedonia, India, and Mesopotamia, to men in the Royal Navy, and to a naval prisoner at Doberitz. Professional papers, which are given by the *Builder*, *Architects' and Builder Journal*, THE SURVEYOR, and *Country Life*, are sent weekly to forty men. Many letters have been received saying how much these are appreciated. A number of men on leave have called at the Architectural Association offices to thank the committee personally for the parcels and papers sent to them. Many hundreds of most grateful letters have been received, and new applications are constantly coming in. Among the gifts sent to the committee during the past year have been 2,000 cigarettes, a weekly supply of 250 cigarettes, and a consignment of 216 lb. of chocolate from an American well-wisher. A great deal of voluntary work has been done by Belgian refugees in knitting socks and making ration bags and shirts from material supplied to them. As the committee have the use of the Architectural Association premises, the entire funds are devoted to the needs of the men. The last issued statement of accounts, however, shows that funds have practically come to an end, and unless a prompt and generous response is made to the committee's appeal for subscriptions the work must unfortunately stop. In addition to money, the committee will be grateful for cigarettes, tobacco, shirts, socks, handkerchiefs, pants, vests, scarves, and literature. All cheques and parcels will be gratefully acknowledged, and should be sent to Mrs. Maurice Webb, 37 Great Smith-street, Westminster, S.W.

* * *

Road Services in France.

The appointment of Mr. H. P. Maybury, M.INST.C.E., manager and engineer of the Road Board, to the staff of Sir Eric Geddes, the Inspector-General of Transport, is unquestionably a step in the right direction. It is understood that the particular duty allotted to Brig.-General Maybury is the organisation of the road services in France, and if this be so, municipal engineers will agree that a better appointment could not well have been made. In the present war transport by heavy mechanical traction has developed to an extent which had hitherto not been imagined, and the consequent strain on the roads is enormous. There is little wonder, therefore, that it has been decided to bring the road services up to the highest possible state of perfection. It is all to the good, too, that a real effort is being made to utilise the services of those who are experts in road work. For this purpose a circular has already been issued to local authorities inquiring as to what members of their staffs can be made available for this work. It is proposed that officers shall be given suitable rank as Royal Engineers, with corresponding pay; foremen and gangers as non-commissioned officers, with Royal Engineers' rates of pay; while the men will receive pay at the rate of 3s. a day, with usual separation allowances. Service will be required for the duration of the war, and the corps will not be armed. This new service provides municipal engineers up to the age of fifty with a unique opportunity of utilising their skill and experience in the service of the Crown during the present crisis, and it now lies with them to make the corps a magnificent success.

* * *

An Interesting Paper.

At a recent meeting of the Wiltshire Surveyors' Association a very interesting paper was read by Mr. J. W. Brooke, of Marlborough, in which he dealt with the subject of the influence of geological formation on the settlement of population. Every schoolboy knows that from the earliest times great towns have invariably grown up on the banks of rivers, but apart from this fact geological features have almost invariably been the determining factors in the choice of sites for the settlement of populations. Mr. Brooke instanced his own neighbourhood of Marlborough, where the original settlement was no doubt due to the fact that the tertiary caps gave shelter and security to life, while the secondary stratifications gave, by bournes and springs, an abundance of pure water. In modern times, however, the development of engineering science has rendered man much more independent of geological formation than was the case in former times. For example, rivers and streams have been put into harness, and their course changed by aqueducts, dams, and weirs; communication has been facilitated by the construction of roads, canals, and railways. It has thus become possible for large populations to exist in places that under former conditions would have been impracticable, and modern industrial development has led to vast extensions of town life in the immediate vicinity of the coal measures and metalliferous rocks. This is, of course, only part of the debt which civilisation owes to the engineer, a debt which is none the less real because it is not appreciated by the public at large.

The Future of Granite Macadam and Concrete Roads.

By H. PERCY BOULNOIS, M.Inst.C.E.

The war has so seriously raised the cost of freight that other materials in addition to local stone are being largely used in the construction of bituminous-bound macadam roads. Tarred slag has been on the market for many years, and, more recently, clinker from house-refuse destructors has come into use in many districts.

But, in addition to this, it is often stated that a hard granite will not allow tar or any other bituminous mixture to adhere properly to the surface, and that, consequently, tar-macadam made from broken granite is often a failure. Then, again, there have been numerous failures with bituminous grouting for various reasons, and it has also been argued that the quantity of grouting required either for single or double grouting is largely in excess of that which would be required for ordinary tar-macadam. The carpet system of road making requires a very large proportion of fine sand to the small quantity of crushed stone, and consequently there is beginning to be a feeling that the amount of granite macadam required in the past will not be wanted in the future. On the other hand, there is no doubt that after the war, when matters have resumed their normal course, an immense amount of road construction will be required, and probably a large proportion of this new road making will be ordinary water-bound macadam, with the surface tar-painted. Such a road, if properly constructed, will carry a very large amount of traffic without serious deterioration, and, if this is so, there is no need to construct a more expensive type of road.

CONCRETE ROADS.

Granite is undoubtedly the best rock to use for such a purpose. But, in addition to this, there is a method of road making which, so far as this country is concerned, has not yet met with much success, although in America, Canada, and elsewhere it has been adopted on many hundreds of miles of roadways. Portland cement concrete has for many years been used as a base, or foundation, for various types of pavements, but it is only in the last few years that, in America especially, it has been so successfully employed that many hundreds of miles of such roads have been constructed.*

Why is it that, if such roads can be made in America, we cannot follow suit? If the various American specifications for the construction of concrete roads are carefully studied it will be found that there are a few prime factors which, if followed, will prevent failure, and these factors may be summarised as follows: The cement must be of the highest grade. The size of the coarse aggregate should not exceed a size that will pass through a 1½-in. ring, and the top, or wearing surface, should be of even smaller grade. The sand, of course, must be absolutely clean and sharp, and the proportions should be 1 of cement, 1½ sand, and 3 of broken stone.

CAUSES OF FAILURES.

Our failures seem to have been mainly due to the desire for economy and the consequent weakness of the concrete. Complete and careful mixing is essential, and water should not be added haphazard. The Americans attach considerable importance to the use of a special template for smoothing the surface, and decry the ordinary "floating" method; it is contended that the former process prevents the formation of hollow places, which are necessarily fatal to the surface of any road.

With regard to contraction, or expansion, and the resulting cracks in the surface, it is, of course, essential that the concrete should be laid in alternate bays, but whether it is advisable to leave expansion joints between these bays is a moot point; as such openings may admit water, which is a well-known enemy to every form of road construction.

It is said that expansion and contraction are minimised if the bed on which the concrete is laid is flat, and not contoured to the slopes of the finished road surface; this means that the concrete must be thicker in the centre than the sides, which, according to English practice, is not to be encouraged, as modern practice is to strengthen the haunches of nearly all roads.

Be this as it may, there is another method which undoubtedly should help to prevent cracks, and that is by the insertion of a slight wire reinforcement about 2 in. below the surface of the road. Such a reinforcement is also said to give a slight resilience to the concrete, which otherwise is rather too solid and unresisting for horse-drawn traffic, though, for pneumatic-tyred motors, this effect is not noticeable. Otherwise the Brooklands track probably would not have been made of concrete.

THE KENT COUNTY COUNCIL'S EXPERIMENTS.

It is greatly to be regretted that the experimental length of concrete road which was constructed between Gravesend and Northfleet by the Kent County Council in December, 1914, was not very successful; but this was due to various adverse causes and not to any failure, *per se*, of such a method of construction. First of all the concrete was too weak—1 of cement to 6 parts of pit ballast. This is confirmed by the fact that a portion of the road was constructed with the same aggregate, but in the proportions of 1 to 3, and is now in perfect condition. The traffic on the road is about 1,000 tons a day, consisting of motor 'buses and fast-running commercial motors of great weight. The carriageway is only 21 ft. in width; the traffic was not diverted, so that the concrete was never given a chance of properly consolidating. The weather was bad nearly the whole time, and parts of the road were frequently under water. There were other causes which contributed to a partial failure, but an inspection of the road now will clearly show the causes of this failure.

As an object-lesson in concrete road construction, this road has the advantage over many another trial section of road making, inasmuch as it clearly shows the reasons for failure, and the portion, which is as good as any road could possibly be, shows how a concrete road of excellent strength and perfect surface can be constructed. All engineers know that we often gain more information from failures than we do from successes, and here we have success and failure side by side.

If another length of road could be constructed where the work could be executed on the lines of the American practice indicated, there is no reason why it should not be a complete success and "pave the way" for another development of road construction which would meet modern requirements.

COST.

With regard to cost, the Kent experiment is no criterion, and is therefore negligible; but it must be borne in mind that concrete gets harder the older it is; if a concrete road were made in two courses, say 4-in. base and 2-in. wearing surface, the base would be there practically for ever, and only the wearing surface would require renewal. If the surface were occasionally tar-painted its life would be prolonged, and the repairs would be almost negligible, so that probably it would be found that, if maintenance were taken into account as well as first cost, concrete roads might prove as cheap, or even cheaper, than ordinary water-bound macadam roads.

* During the year 1914 alone it is estimated that no less than 17,000,000 square yards of concrete roads were constructed in America.

Institution of Civil Engineers.—A paper on "Keadby Bridge" will be submitted for discussion by Mr. James B. Ball, M.Inst.C.E., at a meeting of the Institution of Civil Engineers to be held on Tuesday next, at 5.30 p.m.

Glasgow's New Fire Station.—A new fire station which has been built in the southern district of Glasgow was opened recently. It has cost £25,000 to build and equip, and the claim is made that it is the most completely equipped fire station in the United Kingdom. The engine-house has accommodation for four motor fire vehicles, and has automatic folding doors, while in the adjoining watch-room there has been installed the new Siemens fire-alarm apparatus which has cost £1,400. There are houses for thirty-six firemen and their families, and all the buildings in the establishment are lighted by electricity.

Sewage Disposal at Leeds.

TREATMENT DURING 1915-16: ANALYSES AND WORKING COSTS.

The report of the Leeds Sewerage Committee for the year 1915-16, issued this week, is full of most useful information in regard to the work of sewage purification and disposal as carried on under the direction of Mr George A. Hart, M.INST.C.E., M.I.MECH.E.

TREATMENT AT KNOSTROP.

At the disposal works at Knostrop the process of treatment is being carried on as before. The sewage discharged at the main outfall sewer at Knostrop is passed through mechanical screens, and afterwards the dry-weather flow volume is pumped a height of about 12 ft. into continuous flow chemical precipitation tanks of a total capacity of 6¾ million gallons, allowing for a period of settlement to the dry-weather flow sewage of about eight hours.

Milk of lime is mixed with the flow of sewage to precipitate the suspended solid matter which is day by day then pumped from the sewage tanks into sludge storage tanks and allowed to stand for a few hours in quiescent condition; subsequently this settled sludge, containing about 90 per cent water, is forced into the sludge press house and reduced by mechanical presses into compressed sludge cake containing from 55 to 60 per cent water. The clarified effluent from the sewage sedimentation tanks is discharged into the river Aire, near to and below Thwaite Mill weir. The solid sludge cake from the presses is chiefly delivered into railway bogie wagons and conveyed to a tip upon the sewage works estate over a narrow gauge railway, and the surface covered with soil. About 15 per cent of the total output of sludge cake is disposed of to farmers for agricultural purposes.

The total volume of sewage pumped during the year was 5,410,526,000. This represents an average volume of 14,869,027 gallons per day, being 34 gallons per head per day, for a population of 440,000 persons estimated to be draining to the works. This amount is about 6 per cent less than the volume pumped during the same period of the previous year.

The total annual rainfall over the city area, computed from the average of five raingauges, amounted to 23·87 in., as compared with 27·54 in. for the previous year.

The total cost of working the steam power plant in wages and materials amounted to £3,977 17s. 9d., as compared with £3,535 3s. 10d. for the preceding year, being an increase of £442, which is due to a general increase in price of coal, oil, stores, &c., and an increase in wages amounting to 5 per cent on the previous year's wages accounts. The actual working cost, exclusive of interest and sinking fund, in pumping the sewage for the year amounted to £1,710 9s. 10d., as compared with £1,520 2s. 8d. for the previous year. This is equivalent to 6s. 4d. per 1,000,000 gallons lifted an average of 12 ft. high, or 6½d. per 1,000,000 gallons per foot of lift.

Eight hundred and twenty-six tons of garbage have been screened from the sewage by the mechanical screens, as compared with 846 tons for the previous year, which amounts to 3·05 cwt. of screenings per 1,000,000 gallons of sewage treated.

The cost of screening amounted to £369 6s. 11d., being 1s 4½d. per 1,000,000 gallons of sewage screened.

Six hundred and fourteen tons of grit were dug out from the detritus pits by means of a steam crane and Priestman grab, compared with 320 tons for the previous year, being an average of 2·27 cwt. of grit per 1,000,000 gallons of sewage treated.

The amount of lime used for chemical precipitation was 478 tons, as compared with 759 tons for the previous year. The lime was supplied from the Swinden quarry of Mr. P. W. Spencer, of Skipton, at a contract price of 14s. 11d. per ton. The cost of the chemical precipitation process was £890 17s., or 3s. 3¾d. per 1,000,000 gallons of sewage treated, as compared with 3s. 6¾d. for the previous year. The reduced cost is entirely due to the careful supervision which is given to controlling the amount of lime added as the nature of the sewage varies.

The total volume of sludge removed from the tanks amounted to 124,523 tons (average 91·4 per cent water, which was reduced by settlement in the sludge tanks to an average of 90·2 per cent water before being pressed), to which was added 1,163 tons of dry lime. The yield of sludge cake from the presses was 36,338 tons (average percentage of moisture 59·2), which amounts to 23 tons of sludge and 6·7 tons of sludge cake produced per 1,000,000 gallons of sewage treated. The working cost of sludge pressing amounted to £3,366, being 12s. 5½d. per 1,000,000 gallons of sewage treated, or 1s. 10·2d. per ton of sludge cake, as compared with 11s. 0¾d. per 1,000,000 gallons of sewage treated, and 1s. 8·20d. of sludge cake produced during the previous year.

The average number of working hours per week on the sludge pressing plant was fifty-four.

The average analyses of the pressed sludge cake is as follows:—

		Per cent.	
Water	...		59·2
Mineral residue containing calcium phosphate		·75	22·4
Volatile matter ,, fixed carbon	...	5·2	
,, ,, ,, total nitrogen	...	0·56	
,, ,, ,, total fat	...	6·2	18·8
			100·0

Five thousand and thirty-seven and a-half tons of sludge cake were consigned to farmers for manurial purposes, the balance of 31,195 tons being tipped on the sewage works estate and covered over with soil. The consignments to farmers are less than the previous year by 2,805 tons, chiefly owing to shortage of labour.

Crude sewage.				Tank effluent.				
Suspended solids.	Soluble solids.	Albuminoid ammonia.	Oxygen absorbed in 4 hours.	Suspended solids.	Soluble solids.	Albuminoid ammonia.	Oxygen absorbed in 4 hours.	Chlorides as chlorine.
62·6	104·6	·641	14·3	5·4	102·2	·285	6·05	15·9

Four thousand one hundred and ninety-five tons of coal were consumed by the two Lancashire boilers, two small locomotives and one 4-ton steam crane; 4,208,459 gallons of town water was evaporated in the boilers, which amounts to 4·4 lb. of water evaporated per lb. of coal consumed. The coal used during the past year was screened nuts, costing 12s. 6d. per ton delivered at the boilers. The low evaporation figure is due to the low temperature of the feed water and the absence of a fuel economiser. As the present steam plant is a temporary arrangement to be superseded by permanent electrical plant in the immediate future, the committee do not deem it expedient to replace the economiser which has been dismantled as unsafe.

The total cost of the disposal of sludge from the press house was £1,369 16s. 10d., being at the rate of 5s. 0¾d. per 1,000,000 gallons of sewage treated, or 9·04d. per ton of sludge cake produced.

The general expenses of the works amounted to £4,845 15s. 11d., as compared with £3,615 18s. for the previous year. This increase is due to additional rates and taxes, and war bonus to workmen and allowances to employees serving in the Army. The total working cost in treating sewage at this works (exclusive of interest and sinking fund) amounted to £13 681 1s. 6d., being £2 10s. 7d. per 1,000,000 gallons of sewage treated, or 7·46d. per head of population. This is £1,546 in excess of the previous year, when the cost of treating 1,000,000 gallons of

sewage amounted to £2 2s. 3d.—this increase of 8s. 4d. is equal to 18 per cent on the total expenditure for the previous year.

The foregoing table shows the average of analyses of crude sewage and tank effluent discharged into the river Aire during the year ending March 31, 1916, the results being expressed in parts per 100,000.

The suspended solids eliminated from the crude sewage amounted to 91·4 per cent of the total. The amount of oxygen absorbed in four hours at 80 deg. Fahr. in the crude sewage has increased 11·2 per cent, which is no doubt due to the trade effluents under war-time conditions. No progress has been made in the erection of any experimental plant for recovering by-products from Leeds sludge, nor is there any prospect of anything further being undertaken during the period of the war.

PROGRESS OF THORPE STAPLETON WORKS.

The normal progress in constructing these works was seriously interfered with last year, and only that contract work which had been in the main completed, or which required completing, has been proceeded with.

RODLEY WORKS.

These works are situated on the left bank of the river Aire, on the north-west boundary of the city area, and within the urban district of Horsforth. The total area of the site of the works exceeds 80 acres. The area of the city draining to the works comprises 1,558 acres, situated in the Stanningley and Bramley townships. The district is sewered on the combined system, and the population upon the drainage area is about 18,000 persons.

The normal dry-weather flow of sewage was 440,000 gallons per day, being 24½ gallons per head of the population, 60 per cent of this flow being domestic and the remaining 40 per cent liquid trades waste. The total volume of sewage treated during the year was 241,000,000 gallons, being an average daily flow of 662,000 gallons a day, being 37½ gallons per head of population. The total annual rainfall recorded was 28·8 in.

The maximum flow to the works occurred on February 14th, when 1,690,000 gallons was recorded, this being 3·93 times the dry-weather flow.

The liquid trades waste flow consists chiefly of waste from woollen cloth scouring and dyeing processes.

Briefly, the works consist of primary settlement tanks or detritus pits of four and a-half hours' settlement capacity, followed by further tanks of fifteen hours' settlement capacity, measured on the dry-weather flow. The whole flow of sewage and storm water to six times the dry-weather flow is passed through these tanks, and the tank effluent is subsequently treated partly upon two percolating filters or bacteria beds, from 8 ft. to 9 ft. deep, of a total capacity of 4,800 cub. yds. The average flow passed through these filters amounted to 335,000 gallons per day. The balance of the tank effluent amounted to 289,000 gallons per day, and was filtered through an area of 28½ acres of sewage farm land. A further area of 20½ acres of land is available for treatment of the bacteria bed effluent, and was used for this purpose for six months of the year in the spring and summer seasons. The sludge deposited in the detritus and settlement tanks is dried in lagoons. The volume of liquid sludge deposited in the detritus tanks amounted to 225,000 gallons per annum, containing about 88 per cent water, and the volume of sludge deposited and removed from the settlement tanks amounts to about 125,000 gallons per annum (about 82 per cent water).

The chemical analyses of the sewage and effluents during the year show an effective purification of 88 per cent, measured on the amount of oxygen absorbed in four hours at 80 deg. Cent., and of 94·4 per cent in the amount of suspended solids eliminated.

Forty-eight and three-quarter acres of land is utilised for farming as well as for sewage purposes. The following are the particulars of the crops grown: Grass land (for hay), 14 acres; oats, 9½ acres; swedes, 5 acres; mangolds, 11½ acres; raspberries, &c., ¼ acre; wheat, 5 acres; pasture land, 1½ acres; potatoes, 2½ acres.

The nett cost of purifying the sewage, exclusive of interest and sinking fund on capital account, was £311 15s. 9d., being 4·16d. per head of population per annum, or £1 6s. per 1,000,000 gallons of sewage treated. The nett cost of purifying the sewage, including interest and sinking fund, amounted to 2s. 2d. per head of population per annum, or £8 4s. per 1,000 000 gallons of sewage treated.

The receipts from the sale produce amounted to £383 14s., to which may be added the value of produce remaining unsold, estimated at £37 18s. 8d., making a total credit to farm account of £421 12s. 8d., which shows a nett profit of £112 4s. 5d.

KILLINGBECK WORKS.

These works, situated near Halton Hill on the Leeds and York road, deal with the sewage of the townships of Roundhay and Seacroft, to which has been added portions of Shadwell and Crossgates Ward. The total population upon the district area connected to the works is estimated to be 9,500 persons. The average dry-weather flow of sewage was 354,500 gallons per day, which includes 57,000 gallons of sewage daily from a large munition factory. The sewage treatment works consist of two detritus and screening chambers, each of 6,000 gallons capacity, and three upward flow sewage tanks of a total of 200,000 gallons capacity. The tank effluent is treated on two percolating filters, 6 ft. deep, of a total capacity of 1,700 cub. yds. The sewage is distributed over the filter by means of two Fiddian and Ames Crosta rectangular distributors. The bacteria bed effluent is settled in three shallow humus tanks—the final effluent from the humus tank is discharged into the small stream called Halton Beck. Storm water in excess of three times the dry-weather flow is settled in three storm-water tanks of a total capacity of 130,000 gallons. Sludge from the sewage and storm-water tanks is pumped and dried in special sludge drying-beds.

The chemical analyses of the sewage and effluents during the year show an effective purification of 72·8 per cent, measured on the amount of oxygen absorbed in four hours, and of 80 per cent in the amount of suspended solids eliminated.

STANKS WORKS.

These works deal with the sewage of a portion of the Crossgates Ward within the city, which is outside the area draining to the Killingbeck works. The works drain into the Cock Beck, which is tributary to the river Wharfe. The population may be taken at 500 persons, and the dry-weather flow of sewage at 7,500 gallons of sewage per day. The total working expenses for the year was £65.

TRADE EFFLUENTS DISCHARGED INTO SEWERS.

The supervision of this branch of sewage treatment has materially suffered during the current year owing to a depleted staff. Seven hundred and eighteen visits to manufacturing premises to inspect the plant in operation for treating liquid trade waste were made, being 50 per cent of the normal number of inspections. The woollen piece scouring trades which normally recover grease from soap emulsions have been unable to obtain adequate supplies of sulphuric acid required to solidify the grease to be recovered, and considerable waste of grease has been unavoidable. The Government have arranged for nitre cake to be supplied, and to some extent this waste of grease has been curtailed. Unfortunately, nitre cake is a heavy bulky material for the purpose and requires considerable manual labour in its application, and the supply of labour has not been adequately maintained to achieve satisfactory results, with the result that periodical discharges of considerable quantities of liquids containing tarry products have occurred throughout the year—the source of which has not been definitely proved. These discharges are causing anxiety, as they are not only unamenable to any reasonable form of treatment, but certain products of tar are a source of danger both to sewers and to the men engaged in them and on sewage purification work.

The amount of solid matter contained in the crude sewage during the past year is shown by chemical analysis to have increased by 25 per cent as compared with the average of the previous year, and the normal strength of the sewage in impurity, gauged by the amount of oxygen absorbed, has increased by 11 per cent. These facts are in the main caused by the influence of these trade effluents in abnormal times. The total average daily volume of liquid trades waste was 3,750,000 gallons per day, being 24 per cent of the total daily flow of sewage.

During the past year the average daily flow has probably amounted to 4,500,000 gallons, or one-third of the total daily flow of sewage.

Town Planning in Wales.

WITH SPECIAL REFERENCE TO THE DEVELOPMENT OF HILLY SITES.*

By T. ALWYN LLOYD, LIC.R.I.B.A.

Until the comparatively recent rapid development of Cardiff and the commercial assertiveness of its citizens enabled it to become the capital city, Wales possessed no capital. In spite of its commercialism, Cardiff within a comparatively short space of time has been able to establish itself as such in the best sense from a town planning point of view. While mistakes have admittedly been made in the development of its admirable Cathays Park, whose buildings suffer in that they were erected piecemeal, and did not form part of a comprehensive scheme by one great architect, Cardiff's civic centre is a thing of which its citizens may be justly proud. The city council had the forethought to acquire in advance of development a large natural park, practically in the centre of the city, and, by means of the fine sites which it afforded, the city has been able to attract to it many local and national institutions, now housed in magnificent public buildings. We are thus fortunate in Cardiff in having before us an object-lesson in practical civic planning. Though not, as one would wish to see it, in the best "grand manner," Cathays Park has, nevertheless, much charm about its lay-out, and there is dignity and architectural fitness about the new public buildings which it contains.

Having said that in some of the efforts to raise Cardiff to the dignity of a capital city, we have said all that can be said as to any deliberate civic planning in Welsh towns. Swansea, Newport, Merthyr, Llanelly, and the other towns of the South Wales Coalfield are well known for their lack of planning and for the poor standard of buildings there obtaining. Wrexham, the largest town in North Wales, is no better. Swansea, in its Town-hill site, the property of the corporation, possesses a feature which should give a unique opportunity, if the town will rise to it, of demonstrating to the world how a splendid civic centre on a steep hillside above the town can be practicable, pleasing and healthy. A few years ago Mr Raymond Unwin prepared, in conjunction with the then borough surveyor, a very interesting plan for the development of the Town-hill site. If the Swansea Corporation are able to construct their special tramway system for approaching the summit of the hill, and are wise enough to adhere substantially to Mr. Unwin's proposals, their after-the-war housing schemes on Town-hill, and the other buildings which follow, may be made a magnificent adjunct to the town, both as to situation and lay-out.

PROBLEMS IN THE SOUTH WALES COALFIELD.

South Wales, on account of its immense industrial possibilities, and the consequent huge population, is much the more important half of the Principality. The physical conformation of Glamorgan and Monmouthshire roughly resembles the fingers of one's hand, the valleys converging down to the seaports. The mining valleys are invariably narrow ravines, flanked by high hills on each side; the flat spaces in the bed of the valleys are therefore of a minimum width. When one has deducted from this width the spaces occupied by (1) the river or mountain stream, (2) the road up the valley, (3) the railway, and after the colliery surface works and sidings, there is not much space left on the flat land for houses or for those amenities which in any decent civilisation should surround them. Shops, rows of dwellings, chapels, and colliery buildings jostle one another indiscriminately along the tortuous main street, with the inevitable public-house flanking each corner block. The difficulties of street levels, forecourts, back areas, retaining walls, &c., are multifarious. I could speak at length of the many troubles which dog the footsteps of the council's engineer when he has to work out, not only road sections, but drainage schemes for the steep streets. Many of the streets are of such a gradient that handrails are necessary at the sides, as are "corrugated" pavements and roughened road surfaces to prevent the danger of man and beast sliding down from top to bottom.

It seems to me that the development of these areas must be tackled in a very much more comprehensive way than was even thought of in the past. We must think in terms of whole districts of the Coalfield, instead of in terms of isolated valleys or towns. "Regional surveys" should be undertaken; the lines of main road traffic, railway connections, waterways and by-pass roads should be laid down before inquiring too fully into the individual town-planning problems of the places within the areas of the various local authorities.

A great administrative disadvantage in the valleys at the present time is that the rivers running down the centres of them often form the boundary between one local authority and another, thus producing dual control and a network of problems in administration. In all such cases the boundaries should surely be arranged along the watersheds, on the ridges between the valleys, so that the whole of one valley would come within the jurisdiction of a single local authority.

PRESSING NEEDS.

Perhaps the principal need in connection with the town planning of South Wales is the provision of proper communications between the various districts. It is often half a day's journey by rail or road to get from one valley to another, though the distance as the crow flies may be only a few miles. The construction of a few good connecting roads of suitable gradients would go a long way towards solving this difficulty. Then, again, the main "through traffic" roads between the large centres of population should be systematised and improved. They are now often no wider than 15 ft. to 25 ft., whereas they should be 50 ft. to 75 ft. wide to provide proper space for tramways or motor 'buses and the heavy motor lorries which are such a feature to-day of our industrial life.

Another pressing need which exists in nearly every industrial district is the setting apart of land for open spaces and recreation grounds. I have known many cases where the local authority has experienced the greatest difficulty in obtaining a few acres even for the provision of a very necessary burial ground. When the ground landlords have at length consented to part with what is often little better than mountain land for this purpose, local authorities have had to pay exorbitant (building value) prices for it. A town-planning scheme, where areas were definitely allocated for open spaces and public grounds, would effectively prevent the exploitation of the public in this way.

HILLSIDE DEVELOPMENT.

We now come to a brief consideration of the proper method of developing hilly sites. Most of you are no doubt familiar with the diagrams prepared by Mr. Unwin some years ago for the purpose of showing a new method of development by means of narrow roads following the contours, with houses built on the upper sides only. This method is now recognised as the most appropriate and economical way of dealing with the prevalent physical limitations of Welsh building sites. The conventional by-law type of town development is wasteful and hideous enough when applied to level sites, but when applied to hillsides the results are positively appalling.

It is a significant fact that in a number of Welsh valleys the houses are built on the northern slope, and consequently they do not get any benefit from the sun for many months in the year. It is quite obvious that the southern slopes are infinitely preferable, and those promoting Welsh town-planning schemes should not omit to take special account of this fact. Houses built on northern slopes of mining valleys in practice have the front room facing the street to due north, and the kitchen living-room invariably looks on to a dismal back courtyard, formed by the scullery projections, and beyond the courtyard into the excavated area hollowed out of the hillside. There is thus very little chance of getting sunshine into the living-room, and with the parlour facing north the occupants are condemned to a life of cheerlessness of aspect.

If one travels in a railway train winding its way

* Extracts from paper read before the Town Planning Institute on Friday last.

up one of those mining valleys that in a few years have grown from a collection of scattered villages into a large, thriving urban district, what strikes one most is the general untidiness and muddle of the buildings. On examination it will be found that this impression is due to the fact that what one sees chiefly are the backs and unsightly outbuildings of rows of houses on the lower sides of the main streets. These houses often contain cellar dwellings or a large expanse of foundations so high that, in some cases, one may see two storeys below the level of the road. On the lower side of the road buildings such as these give an even more squalid look to the place from the railway than the backs of ordinary premises. On the other or higher side of the road there are the usual buildings, much deeper than they are wide, projecting far into the bank behind. And so one sees nothing but tier upon tier of backs and outbuildings and retaining walls.

Hillside development, more than any other kind, requires buildings with long frontages and shallow depth rather than the reverse arrangement, which is the common, speculative-builder type of plan. Given moderately cheap land, such as one should be able to secure on hillsides, and narrower one-sided roads, there is no reason why schemes with long-fronted, shallow-depth houses should cost much more per house, including any extra land, than the present method of development with wide roads, deep sewer excavations, and so on. The saving in the foundations of houses, steps and retaining walls, &c., alone ought to be more than sufficient to balance the cost of the wider frontages and the greater length of road.

I feel sure that the old method of housing colliers and other industrial workers close to the scenes of their daily toil is destined to pass away. Colliery owners, naturally, like men to live near their work, because in that way the men are more tied to the one colliery; but a certain feeling against the practice is growing among the colliers and other workers. It is not at all uncommon in South Wales to find men living 4 or 5 miles away from their work and walking or cycling that distance daily. One well-known public man told me a few years ago that he believed that such of those large industrial areas as have been entirely spoilt for residential purposes, on account of smoke and colliery tips and noise, &c., should be given up entirely to industry and business, and that the men engaged therein and their families should be encouraged to reside in new communities amid good surroundings many miles away. Given improved fast electric train services, there would appear to be little objection to this pious hope for the future; but, short of such a revolution, our local authorities and others should make an effort to preserve what few amenities still exist in the mining valleys. This can only be done by a wide application of town-planning powers.

With regard to the vital question of access to the higher land, I see no reason why in special cases "cliff tramways" should not be established. It has been found practicable to construct such tramways in many of our watering-places to connect the beach with the district on the cliffs above, and they are only revenue-producing in the summer. There would thus appear to be no reason why the system should not be applied in the direction of giving easy access to the steeper hillsides of our mining valleys. Such a method of transit would also enable the comparatively flat tablelands on the tops of the hills, which are now derelict, to be developed, provided proper drainage, lighting and water facilities could be obtained.

Needless to say, it is quite hopeless to attempt to deal with the town planning of hilly districts without a drastic amendment of the present by-laws. The case for more elastic by-laws is unanswerable when we are dealing with flat or slightly undulating areas. When, as in the case of South Wales, the bulk of the development in and around towns takes place on hilly sites, drastic alterations of the by-laws are even more essential. One or two of the more progressive district councils have already moved in the right direction by adopting new by-laws which sanction narrow roads running with the contours of the hillsides, with buildings on the upper side of the road only. Other concessions in the way of narrower carriageways, or a lighter make-up of roads in return for greater space between the houses, are occasionally permitted, but the great bulk of local authorities in Wales, as elsewhere, insist on the rigid observance of the usual stereotyped by-laws, which were obviously drafted originally for use in flat districts.

CONDITIONS IN NORTH WALES.

I should now like to refer briefly to town planning in North Wales. With the exception of the Denbighshire and Flintshire Coalfield, whose centres are Wrexham and Mold, the ironworks, chemical, and brick-making industries in the same district, and the slate-quarrying districts of Festiniog, Bethesda, and Pen-y-groes, practically the whole of North Wales is rural in character.

The physical conformation of the North Wales Coalfield makes it an easier area to town plan than South Wales. The colliery districts are in more open situations, and do not present the many difficulties of the narrow valleys in South Wales. There are thus much greater possibilities in regard to roads and sites for housing; but the existing colliery villages are none the more pleasing on this account. For sheer ugliness and dull, sordid monotony it would be difficult, even in South Wales, to find a worse example of urban conditions than those prevailing at Rhos, between Wrexham and Ruabon.

I am glad to say that both the Wrexham Borough and the Wrexham Rural District Councils have embarked upon town-planning schemes. The latter is a huge area, comprising colliery and brick-making centres.

I feel that a great deal could be done in the way of improving the appearance, particularly the outskirts, of the small towns, which are often market centres of their rural industries. If new and better houses are built, and the towns in other ways made more attractive, and also new small industries introduced, it would do a good deal to prevent the drift of the younger men from them into the large towns. That, surely, is a work of great importance. The planning of rural villages and country towns is almost as important as that of the more populous areas, and for this purpose it seems to me that the county council would be a better agency to undertake the work than the scattered and less authoritative rural councils. Improvements of main roads, establishment of building lines along the roads and country lanes, and the definite allocation of land for open spaces are some of the matters which require urgent attention.

PROFESSIONAL MEN AND THE WAR.

FROM T-SQUARE TO RIFLE.

In his presidential address last night before the Society of Architects, Mr. Edwin J. Sadgrove, F.R.I.B.A., observed that architects were bearing at least as heavy a burden as any other section of the community, and doing it cheerfully, recognising that the nation's first business was to win its way to such a decisive and lasting peace as would preclude for ever the possibility of another upheaval. All matters of professional and personal interest were being made subservient to that end. But was it certain that all, and especially those over military age, were "pulling their weight," and were there not still some who considered it degrading to their professional dignity to get away temporarily from tradition and divert their professional abilities and energies into other and more immediately urgent channels for the good of the national interests? Even if their efforts only resulted in the release of a fighting man, or the keeping of a civilian off the funds of war relief institutions, it was something towards the sum total of man power.

He was aware that many architects had tried unsuccessfully to obtain Government employment of any kind in which their professional services might be utilised in the interests of the country at the present juncture. There was, however, still something to be said for the man who did not wait for opportunity, but, like Napoleon, made it. What he wanted to emphasise was the need for each of them, according to their individual capacity, to "go all out" for the end in view. An architect was no less an architect because he had temporarily exchanged the T-square for the rifle, and the same argument held good in other forms of war service, and they would none of them be worse architects after the war for having had their outlook widened and their views on some matters modified or enlarged as the case might be, by the experiences and trials through which we were passing.

Sewage Treatment by Aëration and Activation : The Development of the Process.*

By GEORGE T HAMMOND, Engineer-in-Charge of the Sewage Experiment Station, Bureau of Sewers, Brooklyn.

By far the most interesting development in methods of treating sewage brought forward in recent years is that known as activated sludge, a name invented by Dr. Gilbert Fowler, of Manchester, England, to describe a process which, although as yet within the range of study and experimentation, has already taken its place among approved methods of sewage treatment, and promises possibly to occupy the entire field if the problems connected with it can be solved by a more extensive general experience in its application. It is admitted that there are still many things to be learned about it and difficulties to be overcome, but it may be said justly that it gives at present great promise.

It is the purpose of this paper to present, from an engineer's standpoint, a general review of the subject, and point out the progress made up to this time in a broad manner.

The essential feature of the so-called "activated-sludge" process of sewage purification is the artificial application of well-known natural biological agencies, which, in the presence of an abundant supply of atmospheric oxygen, produce biochemical changes in the organic matter in the sewage and render the sewage "stable," or incapable of putrefactive changes. This result is obtained by the biological oxidation of the organic impurities which are decomposable. The oxidising bacteria obtain their food supply and the energy employed in their life processes from the organic material in the sewage which, in the presence of atmospheric oxygen, they rapidly attack and oxidise.

For many years the principal object of sanitary engineers in the design of sewage treatment and disposal plants has been to bring together in the most suitable and efficient manner the decomposable materials, the oxidising bacteria, and an abundant air supply for the bacteria.

In America the Massachusetts State Board of Health was the pioneer, and its work is known throughout the world. In 1890 this board published a special report, in which are described experiments which were begun in 1888. This report is generally acknowledged as the starting point from which biological methods of sewage treatment originate.

It can be demonstrated that the biological process of sewage treatment is essentially the same, whether filter beds, sand filters, contact filters, percolating filters, &c., are used, or a tank in which sewage is subjected to compressed air in the presence of activated sludge. This point has been discussed by Mr. O. J. Wilkinson, of Manchester, England, who shows that, apart from the mere added effect of the agitation caused by the air in a filled tank, aëration of sewage in the presence of activated sludge is a reversal of the well-known methods of filtration on bacteria beds.

THE REAL PROBLEM.

The real problem is to ascertain the most economical method of applying air to sewage, with maintenance of complete circulation of the activated sludge without any formation of dead banks of material, to reproduce in the tank the changes that occur in a percolating filter bed.

The application of air to sewage has been accomplished by various designs of apparatus, among which should be mentioned the method of employing the flowing stream of sewage entering the tank to compress the air used in the treatment and apply it while flowing and under pressure. A patent covering this method was granted to Cecil C. E. Beddoes by the United States Patent Office, August 4, 1908. It is No. 895,229. The deep tank of Black and Phelps, developed at Brooklyn, New York, provided with trellis baffles set at right angle to the flow, and the tank-aërator with slate colloiders of Clark, at the Lawrence Experimental Station, should be referred to, as well as the activating tank of Dr. Gilbert Fowler, which was, as he has himself freely stated, developed from the experimental work of Clark, seen by him at Lawrence in 1912.

In January, 1910, the Board of Estimate and Apportionment of the city of New York secured the professional services of Colonel (now General) William M. Black, Corps of Engineers, U.S.A., and Professor Earle B. Phelps, Professor of Chemistry, Hygienic Laboratory, United States Public Health Service, Washington, D.C., to conduct for the guidance of the municipal authorities some investigations relative to the problem of sewage treatment and discharge into the local waterways.

In connection with this assignment, Messrs. Black and Phelps began experiments in February, 1910, on sewage treatment by means of forced aëration in tanks at the Twenty-sixth Ward Sewage Works in Brooklyn.

The apparatus used by Black and Phelps consisted of tanks in which were placed laths made up in frames or trellises in such manner that the interior space of the tank was practically filled with strips of wood, the surfaces of which were about 1 in. apart in every direction. These surfaces were made as extensive as possible for the residence of bacterial growths. Compressed air was supplied at the bottom of the tank, which was filled with the sewage to be treated. This plan of treatment gave remarkable results, which were later presented in a report to the Board of Estimate and Apportionment and published in 1911.

These experimenters found it possible to reduce the demand of the sewage for oxygen 33 per cent to 50 per cent, in a retention period of about three hours, by using about two volumes of air per volume of sewage and to obtain a higher degree of purification by applying more air.

The Black and Phelps experiments were about the earliest that indicated the discovery of a practicable and successful method of treating sewage by compressed air.

Aëration experimental work received a new impetus at the Lawrence Experiment Station in 1911, and it was while visiting this station in 1912 that Dr. Fowler saw the work which led him to take up the same line of study on his return to England, with Messrs. Ardern and Lockett, the result of which was the activated-sludge process. In these studies "it was established that a well-nitrified effluent could be obtained by six hours' aëration of Manchester sewage in intimate contact with one-fourth of its volume of activated sludge."

Progress with the new method in England has been checked by the war, but studies are being made for several institutions. At Worcester, half of the sewage of the city is under contract to be treated by this method, and at present about 1,000,000 gallons of sewage a day are being treated under this contract, which provides that not more than four parts of suspended matter per 100,000 of sewage shall be present in the effluent, and that it shall be non-putrefactive. These conditions are being successfully complied with.

Following the work at Manchester of Messrs. Ardern and Lockett, the process was successfully tried at Salford on a larger scale, making use of the existing roughing filter beds.

The reports of the English experimenters were received with great interest in America. The writer's attention was called to the paper of Ardern and Lockett by Mr. W. L. Stevenson, of Philadelphia, and by Prof. Earle B. Phelps, late in the autumn of 1914. Meanwhile, Mr. H. C. McRae, of Baltimore, had become informed of these reports and had communicated them to Mr. Leslie C. Frank, of the United States Public Health Service. At about the same time Mr. T. Chalkley Hatton, chief engineer, Milwaukee, Wis., Sewerage Commission, had got into touch with Dr. Fowler and secured his co-operation in conducting experiments at Milwaukee.

The first work of which the writer has knowledge was, however, conducted by Prof. Edward Bartow, at Urbana, Ill., who started his aërating tank November 21, 1914, at Lawrence, Mass. Mr. H. W. Clark started an activated-sludge tank in February, 1915. Early in March, 1915, experiments were commenced at Baltimore, Milwaukee, and Brooklyn; at Chicago, by the sanitary district, in May; at Regina, Saskatchewan, Canada, May 18th; Houston, Texas, began experiments in September.

For the purpose of presenting the progress of the method in this paper, the latest available informa-

* Paper presented at the annual convention of the American Society of Municipal Improvements, held at Newark, N.J., on October 11th.

tion has been obtained from nearly all American plants where it is being studied. Most of these plants have been visited by the writer since the beginning of the present year. Before presenting this data it may, perhaps, be proper to give an account of the author's aëration and activated sludge work at the Brooklyn, New York, Sewage Experimental Station.

EXPERIMENTAL WORK AT BROOKLYN.

Before designing the plant all of the principal sewage disposal plants in America and Europe were visited.

The plant was put into service in the autumn of 1913, and has continued in operation to the present time. The study of every standard form of sewage treatment was provided for.

One of the principal objects in the design was to carry forward to a conclusion the work of Messrs. Phelps and Black, formerly done at the location of this plant. For this purpose an aërator tank and settling tank, following the design used by these investigators, were installed, and a compressor of ample capacity provided. The tank was 12 ft. in diameter and 25 ft. 8 in. deep. Compressed air was supplied by means of a pipe-grid consisting of ¾-in. iron pipes arranged in five circles, connected by a cross of 1¼-in. pipe, through which air entered. The perforations were on top of the pipe as it lay, and were ⅛-in. holes, 6 in. on centres. This grid, or grill, was placed on 7½ in. of broken stone in the bottom of the tank and covered by a like amount of the same broken stone, passing a 2-in. ring, but retained by a 1-in. ring. It has given satisfaction through three years of service, but is beginning to need cleaning at the present time.

One important feature of this tank was the deflector discs, of which there were nine, shaped not unlike wheels, with a trellis-work between the spokes. A supporting 4-in. vertical pipe passed through all of the hubs of these discs. The surface of each was horizontal, and occupied the entire cross-section of the tank, which was thus formed into storey-like compartments communicating through the trellis-work above referred to. They were designed to give a residence to bacterial growths, and to deflect the downward flow of sewage entering at the top of the tank, and to prevent downward streaming, and equalise and give a sinuous motion to the upward flow of air.

The sewage entered this tank from a measuring and quieting tank, and could be studied either on the continuous-flow plan, for which it was originally designed, or on the fill-and-draw plan.

The effluent passed to a secondary settling tank, from which it passed to the sewer.

Operation of this unit in 1914, after some preliminary experiments, gave the following result:—

TANK AERATION BY CONTINUOUS FLOW PLAN.
Average results for June, July, August and September, 1914
(Part per 1,000,000, except as otherwise designated.)

Period of retention in tank aërator, 24 hours, amount of crude sewage treated in 24 hours, 1,000,000 gals., air applied, 2·3 cub. ft. per gallon. Settlement period in tank No. 1, 3 hours 12 minutes.

	Crude sewage.	Tank aërator.	Settling tank No. 1.
Settling matter, c.c. per litre	2·3	5·4	0·2
Total suspended solids	164·	165·	10·
Volatile suspended solids	130·	70·	5·
Total oxygen consumed	68·	38·	5·
Dissolved oxygen consumed	27·	27·	22·
Total dissolved oxygen	1·1	2·1	1·1
Dissolved oxygen demand	191·	65·	31·
Relative stability, percentage undiluted	2·	1··	81·
Do. diluted 1 to 9 with distilled water	5·	9·1	100·

On October 1st the quantity of air was reduced one-half, and under this condition the relative stability of the undiluted effluent fell to 59 per cent.

The stability percentage is based on the ratio of available oxygen to oxygen required to produce complete stability at 20 deg. Cent. in twenty days. The method is that advocated by Prof. Earle B. Phelps.

In March, 1915, some slight changes having been made in the tank, operation was started on the activated sludge method on the fill-and-draw plan of operation. The accumulation of sludge was sufficient by the middle of May, but regular operation, under test conditions, was not started until June 1st.

The cycle began with a period of sedimentation of about one hour, during which air was shut off, followed by a period of discharge of one and a-half hours. Refilling the tank then began, and air was turned on. This continued one and a-half hours; aëration was then continued until the cycle began again, a period of aëration of twenty hours. Air was measured by a Venturi meter. Both influent and effluent sewages were measured.

As will be seen in the accompanying Table 2, a good effluent was obtained on the fill-and-draw method, after five hours' aëration, with seven volumes of air per volume of sewage. This may be compared with the work of the tank aërator in 1914, under the continuous-flow method of aëration, in which the activated sludge was not retained in the tank, with about nine volumes of air and twenty-four hours' aëration, and also with about eighteen volumes of air in the same period of aëration.

Experiments were also successfully made with the continuous-flow plan of operation, but the character of the results was about the same as shown by the foregoing table on an eight-hour retention period. These experiments have not yet been completed, and are in progress.

During the present year the object has been to remove the sludge-forming materials from the sewage by means of tanks, or by screening before treatment, and to see if the sludge itself cannot be activated; also, how much it can be reduced by continued aëration. A series of tanks seems necessary for this, and it seems possible to reduce materially the volume of the sludge by aëration, accompanied by a constant removal of free water. This work has been much interrupted by the need of repairs to tanks and power plant, our plant now having been operated three years, and having been only a temporary structure in the beginning. Another year's work will probably be necessary, and extensive repairs, in order that we may complete our activated-sludge experiments now projected. We have found that our Riensch-Wurl screens, with the coarse aperture of 5/64 in., are too fine to use before activation; probably ½ in. would be fine enough, and ¼ in. might be better.

LAWRENCE EXPERIMENTS.

Besides the data obtained at the Brooklyn Sewage Experiment Station, the author has been able to secure recent information from nearly all of the principal plants doing experimental work on activated sludge. The Lawrence, Mass., Experiment Station reports that it is continuing the work originally started several years ago with the Lawrence aërating tank, and is studying activated sludge. Mr. H. W. Clark, chemist and director, states that both methods give stable effluents, generally speaking, the Lawrence tank method requiring generally more time but less air, the activated sludge effluent being the clearer of the two. He considers that the governing factors in the success of the activated-sludge process are: Cost of power for supplying the air, and a sewage that readily yields to the treatment; and concludes that it is not impossible that certain sewages cannot be purified in this manner.

THE CLEVELAND PLANT.

The plant at Cleveland, Ohio, was designed to treat 1,000,000 gallons of sewage per day, with two hours' aëration of the sewage and about two hours of the settled out sludge, before its return to the entering sewage. The experimental work at this plant, while of great interest, has not yet reached a proper stage for publication. Air is supplied with porous plates, which, the author understands, have been fairly satisfactory. Experiments are being made with aëration for the further reduction of the surplus sludge that seem very promising.

TABLE 2.—RESULTS OF SEWAGE AERATION ON THE FILL AND DRAW PLAN.
(Parts per 1,000,000.)

Month.	Crude sewage.	Hours after refill. 0	2	5	20
Suspended solids—					
June	180	35	24	20	14
July	147	21	12	8	14
August	151	24	12	9	6
Dissolved oxygen—					
June	1·0	0·0	0·1	0·4	2·5
July	0·7	0·0	0·0	0·2	1·7
August	0·5	0·0	0·0	0·1	0·9
Relative stability—					
June	—	14·	31·	76·	100·
July	—	11·	34·	84·	100·
August	—	12·	28·	65·	88·
Oxygen demand—					
June	230·	53·	38·	—	7·
July	173·	62·	38·	—	4·
August	211·	53·	34·	—	11·
Nitrite—					
June	—	0·08	0·11	0·49	1·50
July	—	0·01	0·07	0·25	0·53
August	—	0·10	0·07	0·12	0·66
Nitrate—					
June	—	0·10	0·61	1·20	7·30
July	—	0·00	0·10	0·55	2·80
August	—	0·00	0·10	0·55	2·80
Volume of air per volume of sewage	—	1·17	3·50	7·00	24·55

At Champaign, Ill., a very interesting plant is operating. This plant is under the direction of Prof. Edward Barlow of Illinois Water Survey.

It will be recalled that Prof. Bartow was the first American to start experiments with activated sludge after the English experiments were published, which he did in November, 1914. The results obtained by him in treating sewage by this method have been very gratifying. The present plant has not been very long in operation — about three months. The dissolved oxygen determinations show from 1 to 9 parts per 1,000,000, and stability with methylene blue lasting from five to fifteen days and longer. From 1·5 cub. ft. to 3 cub. ft. of air per gallon has been applied by means of porous plate distributors. The former figure is found to be sufficient. Sludge drying on Imhoff drying beds has not been a success.

(To be concluded.)

MAIN ROAD MAINTENANCE IN KENT.

COUNTY SURVEYOR'S ANNUAL REPORT.

Mr. H. T. Chapman, the county surveyor of Kent, states in his report for the year ended March last that the actual expenditure upon maintenance, tar-painting, and improvement work carried out during that period in connection with the 600½ miles of main roads under his supervision was £123,011. Various credits, however, including a sum of £13,013 received from the Road Board, bring the nett expenditure down to £101,643, which equals £172 per mile.

The total expenditure upon tar-painting, widening, kerbing, channelling, paving, drainage and improved surfacing work was £37 530 as compared with £54 637 in the previous year. The cost represents £62·5 per mile, against £91·0 in 1914-15.

The total cost of tar-painting carriageways amounted to £21,278 2s. 6½d., 736 188 gallons of tar having been used, and the area treated being approximately 3 750,000 super. yds.

There was also 7,003 gallons of tar used in the repairing of footpaths.

The payments for tar represented £9,333 10s. 4d., the average price paid per gallon being 2·9d.

To the urban authorities the county paid £8,787 7s. for the tar painting of 1 541,098 super. yds. of carriageways. Tar-painting proper therefore cost the county council during the year £33,065.

During the year 249½ tons of pitch and 371½ tons of bitumen were used as a matrix for binding granite macadam and the preparation of "carpeting" material. In addition to the foregoing, 306 tons 9 cwt. of prepared asphalt "carpeting" material were laid. The value of the pitch used in the foregoing work was over £343, and of bitumen over £1,757; the prepared carpeting material cost nearly £733 making a total of £2,834 for this class of material.

A table in the report shows that the total quantity of material used upon the roads under direct control was 99,355 tons or yards. This is a decrease of 41,049 tons or yards upon the previous year, and 33,185 tons or yards below the average of the preceding five years.

The average price per ton for granite macadam, exclusive of haulage, was 13s. 5·27d., as compared with 11s. 5·47d. in the previous year, this being an increase of 1s. 11·8d.

The sum of £1,713 has been charged against the year's working as depreciation upon land, buildings, plant and tools, and is made up as follows: One-fiftieth on land and buildings, one-tenth upon rollers, motors, trucks, &c. This depreciation represents a charge of £2·8 per mile.

During the year two 8-ton compound steam rollers, with scarifiers attached were purchased at a cost of £981, and three petrol motor lorries at a cost of £2,275. The rolling and haulage plant now consists of twelve rollers, four petrol motor lorries, and seventeen steam tractors. The twelve rollers were standing an average of twenty-one days each, and the seventeen heavy steam motors an average of forty-nine days each.

The average daily cost of working a steam roller, including repairs, coal, oil, waste, scarifying tynes, insurance, driver and attendant, is 21s. 9d.; that of a steam motor, including all charges, £1 9s. 8d.; and that of a petrol heavy motor £1 11s.

The total cost of haulage during the year amounted to £17,646, of which £11,044 was in respect of hired team labour and mechanical haulage.

GENERAL OBSERVATIONS.

The weather conditions during the autumn of 1915 and the succeeding winter months were most trying to the roads, and the result of the previous twelve months' traffic became, in many cases, only too apparent.

The work of road maintenance and repair was exceptionally difficult owing to diminished supplies of material and shortage of labour consequent on the war. The extraordinary amount of heavy and destructive traffic placed on the most important main roads by naval, military, and munitions operations caused very serious deterioration, which became impossible to prevent, and the effect of which is becoming cumulative. In this connection Mr. Chapman says: "To keep up our roads to the standard to which the Kent roads have been and should be maintained necessitates more labour and materials than they have received during the past year, and it will, under the most favourable conditions, take several years and very greatly increased expenditure to restore them to that condition. The local materials of the county, if suitably treated with pitch and tar for strengthening purposes and bitumen for surfacing, can be very extensively used for reconstructing roads now surfaced with water-bound granite, which material is admittedly unsuitable and uneconomical for the class of traffic now using a large mileage of our main roads. Many much needed and necessary improvements, including strengthening and widening of carriageways, subsoil, and surface-water drainage, have of necessity been deferred. Widenings, improvement of turns, kerbing, channelling, and making-up of footpaths, which were being carried out so extensively prior to the war, have been put off until a more convenient time."

MOTOR OMNIBUSES ON COUNTRY ROADS.

RURAL COUNCIL'S SUCCESSFUL CLAIM.

A case of considerable importance to highway authorities was decided before Mr. Justice Sankey in the Court of King's Bench on Wednesday, when the Abingdon Rural District Council were awarded £350 as expenses incurred in repairs to Foxcombe Hill-road and Wootton-road, between Oxford and Abingdon, because of damage done by the excessive weight and extraordinary traffic of motor omnibuses belonging to the City of Oxford Electric Tramways, Limited.

The defendants denied that they had subjected the roads to excessive weight or extraordinary traffic, or had caused any damage to the roads, and they alleged that the roads had not been properly maintained and repaired.

In giving judgment (the *Times* reports), Mr. Justice Sankey said that whether particular traffic was extraordinary traffic must be a pure question of fact in each case. Counsel for the defendants said that this was the first case in which it had been sought to make the owners of motor omnibuses liable for extraordinary expenses on the ground that such traffic was extraordinary traffic. He (his lordship) thought that statement did not advance the solution of the problem, which depended on the circumstances in which the omnibuses ran over the road. On some roads, like the Strand, motor omnibuses were not extraordinary traffic, on other roads one was just as likely to meet a mastodon as a motor omnibus and in such case it could not be said that the running of a motor omnibus along the road was ordinary traffic. The defendants' omnibuses were much heavier than any of the traffic in the roads in question before the advent of the motor-omnibuses, and a census of the traffic which was taken from September 28 to October 4, 1915, showed the vast preponderance of the omnibuses over any other motor traffic of comparable weight along the roads, there being 135 omnibuses, against eleven covered motor vans, eight motor lorries, and two traction engines with trailers. Counsel for the defendants said that the question was whether a service of omnibuses run to serve the needs of a district could be extraordinary traffic. He (his lordship) was unable to see how the demand of a district for traffic which was extraordinary could turn that traffic into ordinary traffic, although the traffic might be necessary traffic, and might in the future become ordinary traffic. The only thing, however, which he had to consider was the present traffic over the roads as they were at the present time. He came to the conclusion that the traffic in question was extraordinary traffic, and that the roads had been properly kept up, and that the plaintiffs had incurred extraordinary expenses to the amount of £350 in repairing the roads.

TOWN PLANNING OF GREATER LONDON AFTER THE WAR.

At University College, Gower-street, W.C., on Tuesday of last week, Prof. S. D. Adshead delivered the first of a series of six lectures on the above subject.

In taking a comprehensive view of city extension, said the lecturer, one of the problems with which we were faced was that of facilitating and guiding the movements of populations brought about by the vast improvements in passenger transit recently introduced. There was proceeding to-day around London a constant building up of new suburbs, and the success and rapid development of these depended, among other things of minor importance, upon their accessibility, and in the case of suburbs for the middle class upon the care with which they were developed and the natural amenities which they enjoyed. For our diurnal journeys between suburb and town we had steam and electric trains, trams and motor 'buses. Each of these had its part to play, and each in a well-regulated system should have its separate and distinct part to play. Competitions should be converted into collaboration, and collaboration should be the keynote of every system of transport projected in the future.

"Having provided the residents in Greater London with a system of electrified lines over which will run rapid electric trains whereby one can be transported to within, say, two minutes' walk of any position in the central area, the next important problem concerns the way in which this is put into effect. With an electric service threading Greater London in every direction, unless newly constructed lines are controlled more effectively than railway lines have been in the past, I mean in the method of constructing the line so as to avoid level crossings and ugly embankments, what remains of the existing beautiful stretches of open country, and opportunities for the natural spread of suburban areas, will irretrievably be lost. Town planning should not only precede road construction, but also it should precede railway plotting, and, desirable areas for new developments having been decided upon, railways may be made to pass through them or alongside of them, but always in tube or cutting.

"Another problem which is continually met with in the planning of city extension is how to deal with old places of historic interest that lie in the route of progression. Within 10 miles of Charing Cross there are numerous old places of historic importance, of great beauty, and priceless interest. They are being rapidly absorbed, defaced, reconstructed, and swept away to give place to street widenings, a more modern type of building, and what may be described as every kind of economic convenience, to the loss of more intangible, but at the same time very real, assets. . . .

"In my own recollection Barnes was a perfectly delightful village; now the greater part of it has vanished, and the rest threatens rapidly to disappear. Had there been a town plan made for Barnes about thirty years ago, New Barnes could have been planned in open fields, and made a really fine place, instead of the topsy-turvy collection of the worst specimens of modern architecture to be found anywhere. A village street carefully preserved and restored would have been a valuable asset to the newer town, acquired without any outlay.

"Other places on the river, like Chelsea, Chiswick, Mortlake, Strand-on-the-Green, and Kew, Isleworth, and Twickenham, are similarly threatened, and delightful spots like Mitcham, Morden, Edgware, and Eltham have also a distressing outlook. It is a great problem as to whether such places should be saved. In my own view main roads should be planned so as to avoid intersecting such places, and new stations should be decided upon . . . so that the main approach from the new development is not through one of these old hamlets. . . . As far as possible they should be left in the lurch, or, as the Americans say, 'side-stepped.' The Germans, whose appreciation of other people's artistic treasures is but too well known, are singularly alive to their value when they are their own. In rapidly developing German towns like Cologne and Frankfurt the old mediæval centre has been left intact, and carefully restored and preserved. To destroy the river front of The Mall, Chiswick, or the Village Green at Mitcham, would be an unpardonable sin which future generations would everlastingly deplore.

PLANNING OF MAIN ROADS.

"Then there is the problem of the planning of and treatment of main roads where they pass through existing or prospective residential areas. I am not one of those who contend that by-pass roads should be constructed around every nucleus. It is my view that main roads, if properly constructed, are best planned when taken through the centres of towns. Drivers of vehicles like to go through towns, and motorists after a 5-mile or 10-mile uninterrupted run have no objection to a reduction of speed. The essential thing to be remembered in planning such areas is that, where there are shops, there should be at least 80 ft. between the buildings and a 50-ft. roadway, and in the interest of residents, where the approach is through a residential area, there should, whenever possible, be an intervening grass space between the road and the garden fence of at least 50 ft.—100 ft. is better where possible. There are many such roads near London. A typical one is at Totteridge, and there is also a good example at Orchard-place, near Old Oak, East Acton. The application of this principle can, of course, only be expected to apply in the case of main arterial and circumferential roads, and in such cases, where possible, there should be a subsidiary service road of 16 ft., with or without a path on either side.

"Finally, there is the problem of whether we ought to take main roads through parks and public open spaces. As a principle I would say 'No,' but in practice we should have no hesitation in doing so if by so doing a greatly improved route is obtained, and where the open space traversed is on such a scale that the actual loss of ground is immaterial, or can be made up by acquiring additional land on one of its boundaries. One can sympathise with those who would have our open spaces untouched under any circumstances, but there is such a thing as holding to a principle until it becomes a fetish. One cannot lay down in regard to this principles that will withstand universal application—each case must be considered on its merits. But in regard to the appearance of a new main road, let us remember that it can be made a very majestic approach to a town, and that it need not have the appearance of, say, High-street, Brentford, or Willesden-lane. The well-known Chestnut-avenue, Bushey Park, does not, to my mind, disfigure that royal demesne."

The application of town planning principles in a measure worthy of the great capital that London was needed a centralisation of authority such as did not at present exist. Jealous as we were, and should be, of undue interference with local interests, we must appreciate the fact that Greater London was not a congeries of detached villages, having no interest in one another. He believed there was at present on foot a strong movement for the establishment of some central authority with power to plan and finance the making of main roads in so far as the interests of London as a whole were concerned. We should all, and he included the most conservative of them, support this movement; nay, more, we should not rest until there had been established an authority which could deal similarly with open spaces and prospective railways in the same way, for it was only by the exercise of broad views, and by considering London's future in a comprehensive way that the costly mistakes of a century could be avoided, and London take that place in the Empire which she was destined to occupy.

Institution of Electrical Engineers. — A paper entitled "The Parallel Operation of Electric Power Stations" will be read by Mr. J. S. Peck, M.I.E.E., at a meeting of this body on Thursday next, the 23rd inst. The chair will be taken at 8 p.m.

Banbury Sewage Scheme Stopped.—A Banbury sewage scheme has been stopped by the Ministry of Munitions, and the Thames Conservancy have decided to urge that part of the scheme might proceed to prevent further pollution of the river.

City of London Waste Paper Collection.—Since April last the City of London Corporation have made a nett profit of £587 by the sale to contractors of the waste paper from the street and dust refuse of the City. They obtained £2 15s. per ton for it, as against £1 17s. 6d. last year. From March next they are going to take the matter in hand themselves.

The Surveyor
And Municipal and County Engineer.

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THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Does it not show that the general public are now taking a considerable interest in matters of health when we find that a recent issue of *Chambers' Journal* contains an article entitled, "Is the Hygienic Domestic Dustbin Impossible"? But is the writer of that article aware that not only is such a dustbin possible, but that it has been introduced into many towns? Would he be surprised to hear that galvanised iron dustbins are supplied to householders in many towns and cities by the local authority, and that the bins are cleared and disinfected regularly?

* * * *

Are not the military authorities to be congratulated on the choice they have made in securing the services of Mr. H. P. Maybury to advise them on the construction and maintenance of the roads at the Front in France? How many men are there in this country who have had such unique opportunities as Mr. Maybury of studying the practical and theoretical science of road making? Shall we not all wish him a safe and happy return to this country when he has completed his work "over there," and that he will then resume the duties at the Road Board which he had been carrying out with such conspicuous success?

* * * *

Will the electric supply companies throughout the country succeed in their appeals to the Board of Trade Referees with reference to the Excess Profits Tax, on the ground that they are entitled to special consideration owing to the limitations and restrictions imposed upon them by Parliament under their respective Acts? Should they not be able to show that the return on the capital invested has given for many years a very low yield of percentage, and that any further financial burdens imposed on them will tend greatly to cripple the industry?

* * * *

Do not the citizens of a "village near Bristol" show a considerable amount of patriotism when we read in the *Bristol Times and Mirror* that a party of them were observed the other day busily engaged in road repairs, and that the gang consisted of a landowner, a banker, a director of a large manufacturer, a farmer, a gardener, a chauffeur, and a clerk? Was it not rather amusing also that the writer of the paragraph proceeded to criticise their dress, which, from his description, did appear to be slightly incongruous? Should we not, however, excuse these patriotic men if they do not possess in their respective wardrobes a navvy's costume? Has it not been often laid down that clothes don't make the man?

* * * *

To what uses are all the offices now being feverishly erected in the dry bottom of the lake in St. James's Park going to be applied? Will not London soon be turned into a huge Government departmental colony, and shall we be saying to ourselves some day, "If commissions and committees are going to win this war, do we not stand a very fair chance of doing so"? Is it a fact that when a war is really progressing the pen is mightier than the sword?

* * * *

Is it a fact that the traffic on Fifth Avenue, at Forty-second Street, New York, is the heaviest in the world? Although recent statistics show that 1,149 vehicles passed this spot in an hour, the weights are not given, and it is more than possible that the weight of traffic carried on the dock line of streets in Liverpool is greater than that claimed for Fifth Avenue. Is it not to be regretted that such statistics are not always reduced to tons per yard width per hour, or day, or some such unit which can be easily compared? When we read that the traffic in the Strand is sometimes 900 vehicles per hour, and in the Boulevard de Capucines in Paris 600 an hour, does this convey any real meaning as to the effect of such traffic on the surface of a road?

* * * *

Is there not in the *Engineering Review* of last month an excellent article by Mr. Noble Twelvetrees on "The Maintenance and Improvement of Main Roads," in which he reviews several of the annual reports of county surveyors, and draws attention to the serious condition of the roads in this country, and the need for Government action to prevent the starving of our highways? Is it not a fact that, if a road is allowed to get beyond a certain condition of disrepair, the amount required to reconstruct it will be immeasurably greater than that which would have been spent in keeping it in repair? Was it not an evil day for this country when the Government earmarked this very necessary expenditure in their scheme of retrenchment?

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

At the last meeting of the council of the Institution of Municipal and County Engineers it was resolved, on the recommendation of the General Purposes Committee, that the Certificate in County and Highway Engineering be recognised as an engineering qualification under by-law (2) section (*b*) for associate membership of the institution.

Messrs. H. E. Folkes, surveyor to the Lye and Wollescote Urban District Council; W. J. Earle, examining draughtsman, Public Works Department, Sydney, N.S.W.; W. Jervis, county road surveyor, East Suffolk County Council; W. T. Mansfield, town engineer and town clerk, Darwin Territory (Northern), Australia; and F. Thurlby, sanitary engineer and surveyor, Wortley Rural District Council, were elected members; and Messrs. W. E. Orchard, deputy borough surveyor, Pembroke, and A. Rahim, assistant civil engineer, Public Works Department, Punjab, India, associate members of the institution.

The council adopted a proposition of the General Purposes Committee that students who are engaged in naval or military duties, or on work connected with the war, and who shall become ineligible under by-law 3, shall be retained in the class of students for such time as the council shall determine.

Mr. Thomas Cole, the consultant secretary, was appointed representative on the Professional Classes War Relief Council, in place of the secretary, resigned.

Civil Engineers and Parliamentary Representation.—While the legal profession had 200 Members of Parliament, civil engineering, it was pointed out by Mr. James Glover, at a meeting of the Liverpool Engineering Society on Wednesday, was without a single representative in the House of Commons.

SNOW REMOVAL.

COMBINED HAND PLOUGH AND SCRAPER.

In addition to the snow-clearing appliances to which reference was made in last week's SURVEYOR, the Patent Snowplough Company, Mytholmroyd, Yorks, have placed on the market the hand plough and scraper illustrated below.

Very often snow falls to such a slight depth that, although it is a source of danger and discomfort to pedestrians, it is not worth while to send out a snow-plough. This hand plough, the makers state, "is a simple and effective means of removing light snow or slush, and one man using it can do the work of three

or four men using ordinary scrapers." It is so constructed that the scraper can be set either at right angles to the handle, for use as an ordinary scraper, or inclined to the left or right to form a very effective hand plough for other scrapers. But as a snow-plough the man using it pushes it along at an ordinary walking pace, and the snow is delivered off at the outward end of the blade. The three positions are obtained by removing a pin, placing the blade at the desired angle, and replacing the pin.

The appliance is one which should find favour with the officials of towns and districts in which women are employed on the roads.

DUMPING OF SNOW INTO SEWER MANHOLES.

At the last convention of the American Society of Municipal Improvements one of the readers of papers, Mr. H. S. Richards, furnished a description of an ingenious apparatus which he has devised for facilitating the disposal of snow by the process of dumping the material into sewer manholes.

The apparatus consists of a water turbine fitted with three blades and mounted in a wire cage or basket of a suitable size. The turbine was connected with a fire hydrant, the stream of water revolving the turbine and then flowing through the wire basket into the sewer. The free blades on the turbine agitated the snow shovelled into the basket and mixed with the water, which carried it on through the sewer. With a pressure of from 15 lb. to 20 lb. the machine disposed of all the snow that two men could shovel into the wire basket, and with a higher pressure it is calculated that it could deal with all that four men could shovel into it.

MUNICIPAL SCHEMES AFTER THE WAR.

East Suffolk C.C.—The county surveyor (Mr. W. Jervis) has prepared a report, showing expenditure on the roads of £35,500, which would employ 250 men for nine months. It has been agreed to send this report to the Local Government Board. The reconstruction of Wilford Bridge is suggested.

Finchley U.D.C.—The following is the list of the various schemes likely to be carried out by the council: Wood paving of carriageways and slab paving of footways to main and light railway roads, £70,000 to £80,000; extensions to generating plant and to mains, feeders and consumers' services, £35,000; additional filter-beds, humus tanks, and construction of outfall sewer and pumping station, £21,518; private street works, 14th and 15th batches, £16,600; Strawberry-vale retaining wall and widening of Great Northern Railway Bridge, Church End, Finchley, £6,017; refuse destructor, £9,861; disinfecting station, £1,430; convenience, "Bald Faced Stag," £620; Squires-lane school extension, £1,689; Woodhouse estate elementary school, £25,000; workmen's dwellings, second contract, £56,000; open-air swimming bath, £1,200; joint hospital, moiety of cost, £25,000.

Clearing Footpaths and Channels with Hand Snowplough.

Hornsea U.D.C.—The Highways Committee reported that they had in view the erection of eight workmen's dwellings as sanctioned by the Local Government Board, but which had been deferred. The Promenade Committee suggested they should include the expenditure of an approximate sum of £15,000 for works of sea defence, including the extension of the Floral Hall, and the council agreed.

Ossett T.C.—The following schedule of works has been approved: Category "A" (urgently needed)—Extensions at Healey sewage works, private street works; category "B" (desirable at an early date)—housing improvements and privy conversions, hospital extension; category "C" (less important)—surface-water drainage scheme, Runtlings and Broadowler sewers, extensions at gasworks, and the provision of new mains, meters, cookers, and sulphate plant, water extension scheme, town planning schemes, Church-street improvement, and Sowood-road improvement.

Heating and Ventilating Dwelling Houses.*

By C. T. ALFRED HANSSEN, ASSOC.M.INST.C.E.

It has often been said that it is easy to heat a house if we disregard ventilation, and that it is easy to ventilate a house if we disregard the heating, and that it is only when we try to combine heating with ventilation that our troubles begin.

In most countries in Northern Europe and America the winter temperature is much lower than in England, and the cold is too deadly and dangerous to wealth to permit any neglect in the heating of houses, and there it is generally the ventilation that is neglected. In England, where the average temperature of the coldest month is only above freezing point, and where there has been no really cold winter during the last twenty years, it is the heating that is neglected and the ventilation that is encouraged. Although an immense amount of coal is used for heating our houses, it may safely be stated that their average temperature is not much above that of the outside air and although every inducement is offered to the air to enter our houses, by building them with open fireplaces and [illegible] leaky windows often left open during the coldest weather—thin walls and badly fitting doors, it is really a question whether our houses are, after all, much better ventilated than those on the Continent or in America.

Air, in common with all other substances, has that inertia which compels it to remain stationary unless it is acted upon by some force that causes it to move, and it is not, therefore, sufficient to provide openings for the air to enter; it is also necessary to provide some force to compel the air to move through the openings. If, for instance, there is a considerable difference between the temperature of the room and that of the outside air, every opening, however small, will have a current of air passing through it (and if the opening be large enough to examine it by means of a candle flame it can easily be seen that there is a lower current of cold air entering the warm room and an upper current of warm air leaving it). A fire in an open grate will cause a column of warm air to rise through the chimney, and in this manner a large volume of air may be drawn through a room, but it is by no means certain that this air will *ventilate* the room. If the incoming air is colder than the air of the room it will probably sink down to the floor level, flow along the floor to the chimney, and pass out of the room without removing or displacing the vitiated air at the breathing level of the room.

The difficulty of effective ventilation is therefore a double one: first of supplying the air to enter in such a way that it is not felt as a draught, and, secondly, of distributing the entering air over the whole room in such a manner that it really displaces the spent and vitiated air in the room. In bedrooms that are not, as a rule, heated, it is impossible to secure effective ventilation merely by opening a window, as the ventilation stops when the room is cooled down to the temperature of the outside air.

It was stated by Mr. G. T. Beilby, F.R.S., in his evidence before the Royal Commission on Coal Supplies in 1903, that the domestic consumption of coal in the United Kingdom was 36,000,000 tons per annum. As there are about 7,000,000 separate households in the United Kingdom, the average consumption of coal is therefore about 4½ tons of coal per household. As the present average price of coal is at least 30s. per ton, this quantity of coal represents an expenditure of about £54,000,000 per annum, and if this huge expenditure neither heats nor ventilates our houses, it seems high time that the question of heating and ventilation should be reconsidered. . . .

VENTILATION.

Although the essential fact regarding the quantity of air required per person for effective ventilation is fairly well established, the quantity itself, as stated by good authorities, varies within very wide limits. Sir Napier Shaw, F.R.S., in "Air Currents and Laws of Ventilation," demands as a normal unit 1 cub. ft. per second per head, or 3,600 cub. ft. per hour; while Molesworth's Pocket-book under "Ventilation" gives 300 cub. ft. per hour for proper ventilation for a healthy man. The essential fact is that the atmosphere under normal conditions contains 4 parts of carbon dioxide per 10,000 parts of air, and that this proportion should not be unduly increased. The average quantity of air inhaled by an adult is about 16·6 cub. ft. per hour, and the exhaled air contains 4·5 per cent of carbon dioxide, or 450 parts per 10,000. The point in dispute is the quantity of CO_2 which may be allowed in the air of a room over and above the normal quantity of 4 parts per 10,000. If an excess of only 2 parts per 10,000 can be permitted, then the quantity of fresh air required is $(16{\cdot}6 \times \frac{450}{2} =)$ 3,735 cub. ft. per hour, but it, as others maintain, it is quite safe to go up to an excess of 25 parts per 10,000, then only $(16{\cdot}6 \times \frac{450}{25} =)$ 300 cub. ft. per hour are needed.

The essential point in all systems of ventilation is that the incoming fresh air should be uniformly distributed throughout the whole room, and should, as far as possible, displace the vitiated air in the room, and for this purpose the incoming fresh air should have approximately the same temperature as the air in the room, as otherwise convection currents will cause it either to rise to the ceiling if it is warmer, or to fall to the floor level if it is colder than the rest of the air in the room. Under ordinary conditions the air exhaled from the lungs will by virtue of its higher temperature rise towards the ceiling, although its high percentage of carbon dioxide makes it heavier than air of the same temperature. There is a critical point at about 80 deg. Fahr., when the exhaled air no longer rises, but remains stationary at the breathing level of the room, and therefore increases the difficulties of efficient ventilation.

The specific heat of air at constant pressure is 0·238, and one British thermal unit of heat will therefore raise $(\frac{1}{0{\cdot}238} =)$ 4·2 lb. of air 1 deg. Fahr. The volume of 1 lb. of air varies from 12·4 cub. ft. at 32 deg. Fahr. to 13·1 cub. ft. at 60 deg. Fahr., and at this latter temperature 1 b.t.u. will therefore heat about 55 cub. ft. of air 1 deg. Fahr. The cost of heating a liberal supply of air to a moderate temperature is not, therefore, very heavy, and if suitable apparatus is provided for this purpose it is quite practicable to supply at a very moderate cost the full quantity of air demanded by Sir Napier Shaw.

The cost of heating the air can be estimated when we know the average temperature of the outside air, the proposed temperature of the house to be ventilated, and the volume of air to be introduced into the house.

An average family consists of six persons, and supposing them to require 3,600 cub. ft. per head per hour, an average house should have a supply of 22,000 cub. ft. of air per hour. To introduce this air into the house by means of open windows and open fires is not only a very clumsy method, but it is, during the winter, also a very expensive one. We may hope that one of the first results of national reorganisation may be an abundant supply of cheap electric power, and that this power may be obtainable at a rate of one penny per Board of Trade unit. A well-designed fan with an efficient electric motor supplying the above quantity of air will then work twenty-four hours per day for about 1½d., or 38s. per annum, and will save a great deal more than this value of coal.

For the purpose of heating and ventilating our houses, the year in this country may be divided into two seasons, namely, four months of summer when heating is not necessary, and eight months of winter when artificial heat is required. . . .

If the whole house is heated it may be assumed that an average temperature of 55 deg. Fahr. will be sufficient, that is the bedrooms and corridors should be 50 deg. Fahr., and the sitting-rooms 60 deg. Fahr. There should therefore be an average increase in the temperature of the incoming air of (55·0−44·2=) 10·8 deg. Fahr. One b.t.u. will raise 53·3 cub. ft. of air from 44·2 to 45·2, or 1 deg. Fahr., and taking the thermal value of 1 lb. of coal at 14,000 b.t.u., and the efficiency of the heating apparatus at 80 per cent, the coal consumption during the season will be

$$\left(\frac{5{,}832 \text{ hours} \times 22{,}000 \text{ cub. ft.} \times 10{\cdot}8 \text{ deg. Fahr.}}{53{\cdot}3 \text{ cub. ft.} \times 14{,}000 \text{ b.t.u.} \times 0{\cdot}80 \times 2{,}240 \text{ lb.}} \ldots\right)$$

1·01 tons of ordinary good coal. The heating apparatus must, of course, be arranged in such a manner

* Paper read at a meeting of the Society of Engineers on the 6th inst.

that it can do the maximum work equal to at least three times the average, and it should be as far as possible self-regulating, so that the air should not be overheated during spells of exceptionally mild weather.

It is only by such a complete separation of the ventilating system from the heating system that both can be effectively controlled during all the various conditions of the weather. Some simple system of washing the air should be provided, for the amount of dust and dirt contained in town air is astonishing, and it would save a great deal of dusting and house cleaning if this dirt could be prevented from entering our houses.

Where the air supply is admitted to the room at a moderate temperature slightly cooler than the temperature of the room itself, and with an initial velocity of not more than 2 ft. per second, the inlet openings should be of ample size, adjustable according to the number of persons present in the room and at the breathing level or about 4 ft. 6 in. above the floor. For ordinary rooms the outlet openings may be much smaller, and as all impurities as a rule rise towards the ceiling they should be there, and may conveniently be arranged as adjustable outlet-openings into the chimney-flue.

HEATING.

The most convenient and most sanitary fuel for heating a house is undoubtedly gas, but in order to have gas heating as a practical possibility the cost of gas must be very materially reduced. One pound of coal yields about 14,000 b.t.u., and a ton of coal therefore yields 31,350,000 b.t.u., while the calorific value of a cubic foot of gas may be put at 535 b.t.u. A ton of coal is therefore equivalent to 58,700 cub. ft. of gas, and with gas at 3s. per 1,000 cub. ft. ; this is equivalent to coal at £8 16s. 1d. per ton. Gas is therefore at present far too expensive for continuous heating, and can be used only for cooking and temporary heating of rooms used on special occasions.

If producer gas were added to the present supply, and the mixture used exclusively for heating, distributed more continuously under higher pressure, and with an increased velocity in the mains, it would be possible to distribute it at such a price that it could compete with coal, say at 9d. or 1s. per 1,000 cub. ft. of equivalent heat value. The benefit of this to the community would be enormous. There would be an entire elimination of smoke from the atmosphere and a consequent improvement in the sanitary condition of our towns and cities, the heating and ventilating arrangements would be under perfect and automatic control, and in every household the hard drudgery, done mostly by women, of carrying coal and ashes, lighting fires in the morning, and stoking them every hour of the day, would be entirely abolished, and at the same time all the valuable by-products such as coal tar and sulphate of ammonia, which now poison the air we breathe, would be made available for industry and agriculture. The universal use of gas for heating and cooking is therefore one of the most pressing public needs. . . .

The temperature of an open fire is greatly reduced by the excessive quantity of air passing through it, and this causes incomplete combustion. When coal is used the radiation varies according to the state of the fire, and when fresh coal is put on a great deal of unburnt coal in the form of soot is deposited in the chimney. Soot and unburnt gas escape into the atmosphere without producing heat, and it may be taken for certain that not more than 20 per cent of the heat of the coal is radiated into the room from an open coal fire.

It is this very low efficiency of the open fire, together with the high conductivity of the walls of an ordinary dwelling-house, that makes it so difficult and expensive to heat it during cold weather, and which raises the death-rate during winter and afflicts 90 per cent of the survivors with the various illnesses and ailments due to exposure to cold air.

If therefore our houses are to be efficiently and economically heated, it is first necessary to devise some form of heating apparatus acceptable to the tastes and habits of the British public that will produce a cheerful and pleasant heat without allowing four-fifths of the heating value of the fuel to go up the chimney, and secondly to prevent the heat that has been generated being uselessly dissipated into the outside air.

If the whole house is to be heated the distribution of heat is different from that for heating a single room, as in the former case only the outside walls need to be considered as conducting the heat. We then get for each degree difference of temperature the following losses from an ordinary semi-detached nine-roomed dwelling-house :—

Heat Losses through Outside Walls, Windows, Floors and Upper Ceiling per Hour per 1 deg. Fahr. Difference of Temperature.

Description of exposed surface.	Area of exposed surface. sq. ft.	Heat-loss co-efficient. b.t.u.	Loss of heat per hour, b.t.u.
13½ in. walls facing east	110·8	0·56	62·0
,, ,, ,, south and west .	315·0	0·51	160·6
9 in. wall ,, east	276·5	0·73	201·9
,, ,, ,, south and west	1116·5	0·66	736·9
,, partition wall between the two houses	957·0	0·60	574·2
Windows facing east	173·5	2·02	350·5
,, ,, south and west .	115·5	1·84	212·5
Doors ,, east	15·0	0·81	12·1
,, ,, west	17·5	0·74	13·0
Floor of house above ground level at ground floor	677·0	0·30	203·1
Top ceiling of house	677 0	0·42	284·3
Total heat-losses per hour per 1 deg. Fahr. temperature		=	2811·1
Heating air for ventilation when the air is taken from the outside and heated in a special heater $\frac{22,000}{53·3}$ b.t.u.		=	413·0
Heat expenditure in b.t.u. per hour per 1 deg. Fahr. temp.		=	3224·1

To heat such a house during the whole of the cold season from an average outside temperature of 44·2 deg. Fahr. to an average inside temperature of 55 deg. Fahr.—that is to raise its temperature through an average of 10·8 deg. Fahr.—would require the following expenditure of heat :—

Heating ... 5,832 hours × 2811 × 10·8 deg. Fahr = 177,058,800 b.t.u.
Ventilation ... 5,832 ,, × 413 × 10·8 deg Fahr = 26,013,000 ,,

Total heat per season b.t.u. ... 203,071,800 ,,

That is, if we would attempt to heat an average suburban house to the very moderate temperature of 55 deg. Fahr. during the whole of the cold season with open fires having an efficiency of 20 per cent, then each house would want a coal supply of

$$\left(\frac{203,071,800}{14,000 \times 0·20 \times 2240} = \right)$$

say 32½ tons per annum, while if it is done with a good system of central heating having an efficiency of 80 per cent, it would require about 8⅛ tons of coal per annum. To heat a house by means of a number of open fires is therefore a task which is beyond the capacity of the average householder, and as central heating installations are expensive to install and somewhat difficult to regulate they are not suitable for the English custom of living in small and separate houses.

Hence the heat insulation of our houses is of great importance, and in most Continental countries, and also in America, this point is carefully attended to, as the walls of the houses are much thicker, the space between the floor joists is, as a rule, filled with non-conducting materials, such as loam and straw, and the windows are double glazed, and in the towns people almost invariably live in flats, which greatly reduces the external wall surface. . . .

The system of heat insulation to be adopted should be one that can be used for existing houses without any excessive expense. Slag-wool appears to the author to be almost an ideal substance for the purpose, as 1 in. of slag-wool is as good an insulator as 1-ft. thickness of brickwork. It is, moreover, fireproof, sound-proof, and vermin-proof, and is at the same time a fairly cheap material. The pre-war price was £4 10s. per ton, which contains 200 cub. ft., so that a layer 4½ in. thick would cover 530 sq. ft. per ton, and therefore cost about 2d. per square foot of external wall surface, and if made in large quantities this price could probably be reduced. At the above price a suburban dwelling-house as described above could have the whole of its external walls, partition wall, ground floor, and upper ceiling effectively insulated, equivalent to about 4 ft. 6 in. extra thickness of brickwork at a cost of about £35. For new houses the walls should be built with a hollow space filled with slag-wool during building. Slag-wool should also be placed between the joists of the floor and above the ceiling. For existing houses slabs of slag-wool may be attached to the inside of the walls. One-inch slag-wool slabs will retain 60 per cent, 2 in. will retain at least 70 per cent, and 4½ in. will retain over 80 per cent of the heat now wasted.

As over 21·3 per cent of the heat lost by conduction passes through the windows, it is of great importance that these should be more carefully fitted, and that they should have double sashes.

A house fitted in this manner would not only be warm and comfortable in the winter, but also cool

during the summer, for the same insulating material which prevents heat losses from within during the winter would prevent the entrance of heat from without during the summer. It would, further, be practically sound-proof, and all the distressing noises, inseparable from great cities and which so frequently disturb the rest of those that are unwell or indisposed, would be kept out of the house.

There would also be a great reduction in the domestic work; not only would the lighting and stoking of fires be abolished, but dust would be prevented from entering, and a great deal less dusting, washing, and house cleaning would be required. If the heat losses are reduced 80 per cent the fuel used for heating the whole house to a comfortable temperature would actually be less than the fuel now used for heating one or two rooms in the very imperfect manner it is done at present. . . .

It would . . . other things being equal, be possible to save nine-tenths of the coal now wasted in inefficient heating and ventilation, and at the same time render both highly efficient and more sanitary.

The author is aware that extensive structural alterations in existing houses are not possible before there is a general demand for them and before tenants have found that the increased rents which they necessitate are amply covered by the decreased expenditure on fuel, and by the sanitary and domestic gains accruing from them. All such improvements are, unfortunately, much hindered by the present system of municipal taxation, which inflicts a heavy quarterly fine on those who build commodious, substantial, and well-equipped houses, while it deals most leniently with the jerry-builder whose houses allow the minimum amount of domestic comfort. The proposed improvements must therefore at present be confined to new houses of the better class, and to existing houses occupied by their owners, and they can become general only when the public has been taught to appreciate their value.

Commercial Motor Users and Petrol Rationing.—The announcement of the Petrol Control Committee concerning increased motor spirit allotments to commercial motor users for the next six months has caused consternation among those users. They cannot understand why private car users have, in a great number of instances, been granted increases of 100 per cent and upwards, whereas an increase of only 10 per cent is granted to business users. Mr. F. G. Bristow, secretary of the Commercial Motor Users Association, 83 Pall Mall, S.W., states that there are many thousands of users of motor vans who are now getting less than 80 gallons per month, on which quantity a 10 per cent increase is only a matter of 8 gallons. Comparing these business users with private car users, who from August to October got only 8 gallons a month, but who are now getting 16 gallons a month, the commercial user is very much worse treated. The Commercial Motor Users Association is summoning an emergency meeting of its General Committee, on which the leading London and provincial users are represented, and intends to take all possible steps to secure an improvement in the situation.

TAR SURFACING IN CHISWICK.

ANALYSIS OF COST OF PAST SEASON'S WORK.

In Chiswick the principle of dressing the road surfaces with refined tar has been practised for several years past, and although, principally owing to adverse weather conditions, the amount of work done during the season just ended was not so great as usual, the detailed analysis of the cost, which, by the courtesy of the engineer and surveyor, Mr. Edward Willis, Assoc.M.Inst.C.E., we are enabled to reproduce herewith, will be examined with interest.

One interesting feature in connection with the operations of the current year was the necessity which arose for the employment of women for part of the work involved. The women were principally employed in the preparation of the roads by hand-sweeping, and in occasional gritting and clearing up—the actual handling of the tar was carried out by men over military age.

Whereas in 1915 an area of 160,000 sq. yds. was treated, and in 1914, prior to the war, 264,000 sq. yds., the total area sprayed this year amounted to nearly 123,000 sq. yds.

The price per square yard in 1914 averaged 1·53d. In 1915 this was increased to 1·76d., principally owing to the increased cost of materials and granite chippings being used on all roads; but in the season just completed the average cost per square yard was reduced to 1·40d.

This reduced cost can be attributed to the replacement of male sweepers by women at a lower rate per diem, and the utilisation of fine slag clinker on light-traffic roads in lieu of shingle and granite chippings, which have been unobtainable in the quantities required.

One other factor in the reduced cost for the current year is that in past years the council made a practice of having the roads rolled after dressing with shingle or granite chippings, whereas now, owing to one roller having been sent to France, and there being only one roller driver left for the steam roller and two cranes, the council's labour difficulties have been considerably increased. It is hoped, however, that next season a much larger area will be again dealt with, providing the necessary materials can be obtained.

It may be mentioned that the tar used complied with the Road Board Specification, except in the case of the county subsidised roads, on which a special tar prepared in accordance with the county engineer's specification was employed.

Analysis of Reduced Tar-Painting Work at Chiswick, Season 1916.

	Total yards treated.	Area covered per gallon (square yards).	Cost of tar per yard.	Cost of material per yard, chippings, &c.	Cost of fuel per yard.	Cost of manual labour per yard	Cost of team labour per yard.	Total cost per yard.	General information.
			d.	*d.*	*d.*	*d.*	*d.*	*d.*	
Tar and granite chippings ...	55,280	6·05	·54	·55	·05	·26	·22	1·62	Women sweepers, 3/4 per day.
Tar and slag clinker ...	26,197	6·51	·50	·15	·03	·24	·18	1·10	Boiler attendant, 4/10 per day.
Tar and spar	3,200	8·00	·41	·81	·02	·28	·19	1·71	Sprayers, pumpers, and men spreading covering material, 5/- per day.
Tar and grit swept from road re-used	7,147	5·10	·64	—	·04	·28	·15	1·11	Ganger, 6/8 per day.
Tar and shingle	31,095	5·11	·63	·32	·05	·25	·22	1·47	Watchman, 3/6 per night.
Total ...	122,919								Horse, cart and man, 15/- per day.
Average for all classes ...	—	6·15	·54	·36	·04	26	·20	1·40	Tar, per barrel, 10/9. Tar, per gall., 3·225d.

Shrewsbury Housing Schemes.—At a meeting of the Shrewsbury Town Council recently, Alderman Deakin stated that the Wingfields Garden scheme, under which some sixty or seventy houses for working men were provided, had proved a great success. There were no arrears of rent. The sanction of the Local Government Board had been obtained for undertaking another housing scheme in the borough as soon as circumstances would permit.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aberdeen T.C.—With reference to the scheme for the extension of the art gallery, which is once more under consideration, Sir James Murray, chairman of the Art Gallery Committee, is confident of raising the sum necessary for the purpose—about £10,000—from voluntary sources.

Bournemouth T.C.—The question of medicated baths in connection with the pavilion has been brought up at the Pavilion Committee, who had instructed the borough engineer, Mr. F. P. Dolamore, to prepare sketch plans of the lower portion of the pavilion and the adjoining sites showing how they could be utilised as baths. These plans are being prepared, and will be submitted to the Pavilion Committee as soon as possible.

Brackley T.C.—The question of the repair of the town hall will be considered by the Town Hall Committee.

East Suffolk C.C.—The Roads and Bridges Committee have accepted the tender of Mr. G. E. Spankle, Ipswich, at £398, for the reconstruction in ferro-concrete of Tuddenham Bridge.

Portsmouth T.C.—The Health Committee are recommending the town council to adapt an eight-roomed house in the grounds of Langstone Hospital as a convalescent home for children, at an estimated cost of £200.

St. Helens T.C.—The borough surveyor, Mr. A. W. Bradley, has been instructed to prepare plans and estimate for a public convenience at the Finger Post.

Saltcoats T.C. — Temporary accommodation for diphtheria and other fever cases is to be provided at the new hospital at a cost not exceeding £450.

HOUSING AND TOWN PLANNING.

Arklow U.D.C.—The council have already built 112 workmen's houses, and it is now proposed to erect more, owing to the congestion of the population caused by an accession of Government workers.

Edinburgh T.C.—The question of providing house accommodation for workers at Rosyth was discussed by a sub-committee of the Lord Provost's Committee, and subsequently the committee visited the areas suggested by the burgh engineer where suitable dwelling-houses might be erected. It is understood that the Local Government Board is very anxious that something should be done immediately, as the need is urgent.

Frome U.D.C.—A committee has been appointed to report upon the advisability of promoting a housing scheme.

Hereford T.C.—A proposal to build sixty-two houses on land owned by the town council has been referred to the Local Government Board, with a view to obtaining a grant in aid from the Government.

Itchen U.D.C.—A town planning scheme is to be prepared for the Western Park area.

Norton U.D.C.—Instructions have been given for the preparation of a town planning scheme for the greater portion of the district.

Tilbury U.D.C.—Correspondence which had taken place between Messrs. Allen & Thompson, architects, and Dr. J. C. Thresh, county medical officer, with regard to the proposed extended housing scheme was before the Town Planning Committee. Dr. Thresh expressed the opinion that the council would be justified in acquiring plans for laying out the whole. It would probably be desirable to obtain sanction of the Local Government Board to the whole scheme, but only to proceed in sections of, say, 200, 200, and 100. For some time after the war loans would bear a high interest, but this would not be so serious a matter if the Local Government Board made a liberal grant. A report by Messrs. Allen & Thompson and the surveyor, Mr. S. A. Hill-Willis, with reference to the preparation of a town planning scheme, was presented. It was decided to serve the necessary notices on property owners and on Orsett Rural District Council, a portion of whose district it was proposed to include in the scheme.

MOTOR TRANSPORT.

Bedwas and Machen U.D.C.—It is proposed to promote a Bill in Parliament to enable the council to run a service of motor 'buses.

Burnley T.C.—The Cleansing Committee have purchased a Leyland motor tipping-wagon.

PARKS AND OPEN SPACES.

Broadstairs U.D.C.—The surveyor, Mr. H. Hurd, has received instructions to construct two bowling rinks.

REFUSE COLLECTION AND DISPOSAL.

Auckland R.D.C.—It has been decided to purchase a site at Coundon Grange for the purpose of a refuse destructor.

Oakham U.D.C.—The surveyor, Mr. A. L. Parker, reported that during the past two months there had been collected 2 tons 1 cwt. of waste paper, for which £4 17s. 6d. had been received. The carriage and sorting cost £2 4s. 6d., leaving a profit of £2 13s.

Sunderland T.C.—The Health Committee advise the purchase of Holme's wharf and other properties now leased by the council, at a cost of £3,500, and also that extensions be effected to provide improved facilities for conveying the refuse out to sea.

ROADS AND MATERIALS.

Antrim C.C.—The council have sanctioned an increase of 3s. a week war bonus to all surfacemen in Ballymoney rural district for the half year October 1, 1916, to March 31, 1917; an increase of 1s. a week to all surfacemen in Lisburn rural district from November 7, 1916; and an increase of 2s. a week to all surfacemen on full time, and similar proportion to all surfacemen not on full time in Ballycastle rural district, commencing on October 1, 1916.

Armagh R.D.C.—It has been decided to spend £200 on the improvement of the Portadown road, which is subject to a large amount of heavy motor traffic.

Bangor U.D.C.—It is proposed to construct a new street off Central-avenue in the near future.

Basford R.D.C.—A proposal to whiten kerbs, lamp-posts and other objects in the streets has been considered by a special committee, who reported that they felt that the public realised that on dark nights they had to be careful. Moreover, to carry out the policy of whitening dangerous obstructions would involve the treatment of trees, lamps, telegraph posts, and other things, and rain would render it necessary for the work to be constantly renewed. The committee recommended that the public be left to take their own precautions to ensure safe travelling on dark nights, and the council agreed to this.

Bexley U.D.C.—The surveyor, Mr. W. T. Howes, has prepared a scheme of street improvement, the cost of which is estimated at £9,424.

Birstall U.D.C.—It has been decided to purchase a sludge cart and a footpath and channel snow plough.

Bridgwater R.D.C.—It is proposed to repair the roadway and bank adjoining Combwich Pill, at an estimated cost of £130.

Bognor U.D.C.—In his report to the council last week, the surveyor, Mr. Oswald A. Bridges, stated: "I visited Worthing last Saturday to inspect the roads which have been laid with tarred material made from clinkers from the refuse destructor, which have answered very well and withstood all the tests of the present-day traffic. I shall certainly try a length in Bognor, with the permission of the Roads and Paving Committee. It has also been tried at Fulham and Hornsey with much success. In fact, most authorities are making it at the present time, as it will provide a useful means of profitably disposing of a material which was almost unsaleable and ever increasing in quantity, and would in time become an encumbrance."

Crediton R.D.C.—In compliance with the wishes of the County Main Roads and Bridges Committee that the main roads in the district should be in the charge

of one surveyor only, it has been agreed to appoint Mr. L. E. Sharland as main roads surveyor, and to raise his salary as surveyor to £108, with an allowance of £20 towards the upkeep of a motor car or motor cycle. At the same time, in consideration of the decrease of Mr. S. Pridham's duties, his salary as road surveyor is to be reduced to £57.

Dudley T.C.—The Public Works Committee recommend the purchase of properties in Flood-street, at a cost of £1,005, for an improvement scheme.

Durham C.C.—It is intimated that the Road Board have made a grant of £600 towards the cost of repairs to the Birtley main road.

East Sussex C.C.—The War Office having requisitioned for urgent use overseas four steam rollers, the property of the county council, the council have agreed to the purchase of four traction engines of a specified type, at a cost not exceeding £3,163, of which £2,322 or more is expected to be received from the War Office. The county surveyor, Mr. F. I. Wood, stated that up to September 30th last he had only received about 14,000 tons of macadam out of the 30,000 tons authorised to be purchased for the repair of the roads for the current year. He also stated that, with the authority of the chairman of the Roads and Bridges Committee, the chairman of the county council, and the chairman of the sub-committee on road tarring, he had extended the area of roads to be tar-treated, with a view to preserving the surfaces of the roads as far as practicable. This action was approved.

Finchley U.D.C.—An expenditure not exceeding £20 has been sanctioned for planting trees in Wood house-road.

Hazel Grove U.D.C.—The surveyor, Mr. G. S. Doncaster, has been instructed to carry out paving works in Torkington-road at an estimated cost of £150.

Lichfield T.C.—A resolution has been passed to purchase a portion of the frontage of the land in Tamworth-road for a widening improvement.

Lurgan U.D.C.—A tar sprayer is to be purchased at a cost of £83.

Macclesfield T.C.—The Highway Committee have resolved to issue a notice to the inhabitants of the borough, asking them to whiten the kerbstones in front of their premises with a view to assisting the public in using the streets during the dark nights. The borough surveyor, Mr. S. C. Baggott, has been instructed to carry out the work in places opposite municipal buildings.

Naas No. 1 R.D.C.—The county surveyor, Mr. J. O'Rorke, at the request of the commanding officer, is preparing for presentation to the Road Board an estimate for steam rolling about 6 miles of road damaged by heavy traffic to the Curragh Camp.

Newton Abbot R.D.C.—The surveyor, Mr. T. A. Phillips, reported that one of the road sections at Bishopsteignton would shortly be without a contractor, as the present one had been called up. Mr. C. Stooke said that the roads at Bishopsteignton were absolutely going to ruin, and it would be a penny-wise-and-pound-foolish policy not to put the necessary labour upon the gutter and water tables. He would advise the council to get as much labour as possible. The surveyor: And where am I to get the men to do the work? It was decided that the surveyor should take over the contract. Mr. J. Whiteway: The Government are offering substitutes to the farmers. Can't they offer substitutes for the men they take off the roads?

Norfolk C.C.—The county surveyor, Mr. W. Gladwell, has submitted a report upon the road direction posts throughout the county, from which it was gathered that it was proposed when necessary and required that iron posts should be substituted for wooden posts. Iron posts would have raised letters, and could be repainted without being taken down, and the work could be done by roadmen if desirable.

Pocklington R.D.C.—The surveyors for the separate districts, Mr. J. R. Greenshaw and Mr. G. W. Mitchell, were given discretionary powers to advance the roadmen's wages to £1 1s. per week without further consulting the council.

Staffs C.C.—It was intimated that the Road Board had agreed to pay a moiety of the cost (£660) of repairing the damage sustained by the Wolverhampton and Dudley main road by heavy traffic. Mr. G. E. Brown protested against private individuals being allowed to use the roads with traffic for which they were never intended, and said that if they charged motor omnibuses they ought to have some ground for making these heavy trading vehicles pay. The chairman said it was a matter for legislation—the council as a body could not do anything. Mr. Homer said they ought to be very careful how they interfered with this matter, because by doing so they might be reducing their rate-producing power. It was reported that damage estimated at about £5,000 had been caused to other main roads, and that the county council were hopeful of obtaining a substantial contribution towards the cost of the repairs.

Truro R.D.C.—It has been agreed to purchase a horse-drawn road scraper, at a cost of £23.

Uxbridge R.D.C.—The council are seeking to obtain 35,000 gallons of tar for spraying purposes.

Woolwich B.C.—The council have authorised the borough engineer, Mr. J. Sutcliffe, to execute works for the supply of materials, steam rolling, and the supervision of various barrack roads for the Road Board, at an estimated cost of £290. The labour and transport will be provided by the military authorities.

Yarmouth T.C.—It is proposed to spend £310 upon the widening of Burgh-road to 50 ft.

SEWERAGE AND SEWAGE DISPOSAL.

Beaconsfield U.D.C.—It has been agreed to plant 4,000 setts of withies (basket-making variety), at 5s. per 1,000, on the sewage farm at Hedgerley.

Bognor U.D.C.—A proposal has been approved to place a distinguishing mark on the footpath in the vicinity of each street gully, so as to enable the gullies to be more easily found when covered by water. It was explained that the proposal was to paint the letter "G" on walls opposite gullies in places where the flooding occurred.

Brandon and Byshottles U.D.C.—The surveyor, Mr. G. G. Donkin, has prepared an reseweoring scheme, which is estimated to cost £290.

Cannock U.D.C.—The Local Government Board are being asked to permit the completion of the scheme for the extension of the sewage disposal works.

Coalville U.D.C.—A scheme is to be prepared for dealing with the Ellistown sewage.

Hucknall U.D.C.—Mr. Sands, the engineer to the sewage disposal works, stated that good value was realised by the sale of crops. In addition, the hay was estimated at 30 tons, and the stack of wheat was calculated to yield 30 quarters. The council decided to increase the salary of the engineer £10 10s. per annum.

Nuneaton T.C.—The corporation have made a profit of no less than £342 on the produce from their farm during the past year. The farm is 80 acres in extent, 20 acres of which is used for the treatment of sewage.

Paul U.D.C.—Replying to a complaint from this council with reference to the pollution of the Tolcarne River, Newlyn, the Mudron Urban District Council state that they had prepared plans and specifications for the carrying out of a complete sewerage scheme for Tolcarne, and deferment of this was no fault of theirs, but owing to the war. They regarded the Paul Urban District Council's threat of complaining to the Local Government Board as a very unnecessary and unfriendly act.

Reeth R.D.C.—The sanitary inspector has suggested that to avoid the choking of the Reeth upper sewage disposal system another filter bed should be made between the tank and the existing filter bed, and charged with coarser gravel.

Walsall T.C.—It is proposed to complete the storm-water sewer at Pleck, at a cost of about £400, as soon as the necessary labour can be obtained.

WATER, GAS, AND ELECTRICITY.

Bognor U.D.C.—The Legal Committee reported that they had considered the proposal of the Bognor Gas Light and Coal Company to increase the charge for electricity from 6d. to 7d. per unit, and to charge for a minimum number of 20 units per quarter, whether consumed or not. The clerk submitted a draft letter, which he suggested should be addressed to the Board of Trade, calling their attention to the proposal and registering their protest against it, in view of the appeals for economy which had recently been made by Ministers of the Government. The draft was approved.

Bromley (Kent) T.C.—It is expected that there will be a saving of £2,000 on street lighting during the ensuing year.

Hereford T.C.—The Gasworks Committee recommend the town council to establish a dehydrating plant and benzol recovery plant at the gasworks.

Islington B.C.—One penny per hour has been added to the wages of employees in the electricity department of the borough council.

Keighley T.C.—The Waterworks Committee recommend that application be made to the Local Government Board for an Order extending the time for the compulsory purchase of land for waterworks purposes.

Lowestoft T.C.—It has been agreed to carry out an electric cable extension to Carlton Colville, at an estimated cost of £200.

Manorhamilton R.D.C.—It has been decided to provide a water supply for the villages of Dromahaire and Drumkeeran, on condition that the ratepayers of the respective villages pay the entire cost of the project. A memorial, signed by the ratepayers of Dromahaire, was submitted, stating that the inhabitants were quite willing to pay for the water. Mr. T. Kelly said the inhabitants of the village of Drumkeeran were too poor, and at present water was selling throughout the village at 10d. per barrel.

Newport (Mon.) T.C.—It was reported that the extension of the Mannesmann Tube Company, which had been acquired by British interests, would entitle the firm to ask the corporation for 500,000 gallons of water per day, according to agreement. The matter was referred to the Waterworks Committee.

MISCELLANEOUS.

Bognor U.D.C.—The surveyor, Mr. Oswald A. Bridges, has reported as follows: "I am now using the hay which was made last summer, which I believe will last me till the spring. This is a great saving, and in consequence only £150 was taken up in the new rate for keeping the horses, instead of the usual sum—viz., £200. I have just purchased four wagon loads of straw (short ends, which is the residue after the saleable straw has been removed), for £2, which is quite good enough for bedding, and will last me through the winter. In this way, and by giving the horses more greenmeat and less corn, as per the instructions of the Horse Committee, I am told by the accountant that about £180 was saved during the last half-year." In the course of the proceedings, Mr. G. W. Gibbs said he thought that the surveyor was to be especially congratulated upon the fact that the sea defences had been so well carried out that practically no damage was sustained in the recent very severe storms. Other members agreed, and the chairman remarked that the bull-nosing to the parade had proved most satisfactory.

FOR OTHER ADVERTISEMENTS

See End of Paper.

WILTS COUNTY COUNCIL.
MAIN ROADS UNDER DIRECT MANAGEMENT.

The Roads and Bridges Committee of the Wilts County Council invite Tenders for a period of one year, commencing 1st day of April next, for the following:—

Granites, Basalts, Limestones, Flints, &c.
Hauling—Piece Work and Day Work.
Steam Rolling.
Tools for Roadwork.
Tar for Tar-spraying.

Specifications and Forms of Tender can, on application, be obtained from the County Surveyor.

Sealed Tenders, addressed to the Clerk of the County Council, County Offices, Trowbridge, must be delivered on or before the 11th day of December, 1916.

No pledge is given that the lowest or any Tender will be accepted.

(By order)
J. GEORGE POWELL,
County Surveyor.

County Surveyor's Office,
Trowbridge.
November 15, 1916. (3,170)

TEMPORARY SURVEYOR'S CLERK required (ineligible for military service); typewriting, tracing, and previous experience in Municipal Office desirable. Applications, giving full particulars of present employment, previous experience, and salary required, to Surveyor, Brentford Urban District Council. (3,171)

PERSONAL.

Mr. Oswald A. Bridges, surveyor to the Bognor Urban District Council, is suffering from an attack of influenza.

Mr. I. Dowson and Mr. J. Liddle, sanitary surveyors to the Auckland Rural District Council, have received a £20 increase of salary.

Mr. T. H. Smith, surveyor and water engineer to the Ilkley Urban District Council, has had his salary increased from £220 to £250 per annum.

Mr. H. H. Dunn, acting county surveyor of Cambridgeshire, has been appointed Adjutant to the 2nd Battalion, Cambs Volunteer Regiment.

Mr. A. L. Parker, surveyor and sanitary inspector to the Oakham Urban District Council, has been voted a war bonus at the rate of £15 a year.

Mr. C. H. Wright, of Barrow-on-Soar, Leicestershire, has been appointed surveyor to the Malling (Kent) Rural District Council, at a salary of £200 per annum.

Mr. W. H. Jukes, surveyor to the Tipton Urban District Council, has had his salary increased by £75, on the understanding that he obtains clerical assistance in the office, to enable him to devote increased attention to the roads.

Mr. Alan Bromly, borough surveyor and water engineer of Godalming, who is thirty-nine years of age, has been granted conditional exemption from military service. Mr. Bromly was rejected last May owing to eyesight trouble, and was classified B2.

Mr. E. E. Finch, engineer to the City of London Corporation, has presented to the Guildhall Library four photographs of the Walbrook sewer which used to run beneath the church of St. Margaret, Lothbury, but was filled in last summer. The pictures reveal masonry and timber work of great antiquity.

Mr. Henry Gregson's services as consulting surveyor to the St. Annes Urban District Council are to be continued for the present, to enable him to render increased assistance to the acting surveyor, Mr. Lawson, whose salary has been increased to £150. The widow of the late surveyor, Mr. J. W. Sawdon, has been voted £250 by the council, and she will receive it in twelve monthly instalments.

Mr. T. Salkield, municipal engineer of Delhi, leaves for France this week for service with the Prince of Wales' Military Commission dealing with British burial grounds. The Director is General Fabian Ware. The British and French Governments are co-operating, and have agreed to maintain in perpetuity all the burial grounds of soldiers in France. The Delhi Municipality have agreed to Mr. Salkield undertaking the service until May, 1918, if required, and the Indian military authorities have released him temporarily from his command of the Delhi Company, 1st Punjab Volunteer Rifles. Mr. Salkield at first takes the rank of Lieutenant in the British Army, but, being a Captain on the Indian Establishment, he will take rank as Hon. Captain.

At Pagani's Restaurant, Great Portland-street, W., on Monday next, Lieutenant Turnbull, R.A.M.C., who has recently been awarded the Military Cross, will be the guest of honour at a dinner and concert arranged by his fellow members of the Municipal and County Club. Sir Edwin Cornwall, M.P., will preside over the gathering.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

APPLICATION FOR LOAN.

Shrewsbury T.C.—£2,200 for the extension of the cemetery.

LOANS SANCTIONED.

Blackburn T.C.—£5,000 for a tar distillation plant.
Poplar B.C.—£4,236 for electricity mains.
Wednesbury T.C.—£6,690 for electricity extensions.

LOAN REFUSED.

Grays U.D.C.—£600 for the purchase of horses, harness, and carts for scavenging purposes.

FORTHCOMING INQUIRIES.

NOVEMBER.

		£
21.—**Neath.**	For works of sewerage and sewage disposal (Mr. A. G. Drury) ...	6,317
22.—**Pontyclun.**	For the construction of a new road (Mr. A. G. Drury)	—

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL GENERAL MEETING.

The [illegible] general meeting of this body will be held at the Hotel Cecil, London, W.C., on Tuesday, December 5th, at 2 p.m., when Dr. Samuel Rideal will read a paper, entitled "Coke Filter Beds," and Mr. Arthur Berry, Canterbury, one on "Modern Sewage Purification Works: Their Design, Construction and Maintenance." A third paper will be contributed by Mr. E. Anderton, M.Sc.

CONCRETE INSTITUTE.

PROGRAMME OF SESSION 1916-17.

Mr. F. E. Wentworth-Sheilds, M.INST.C.E., will on Thursday, the 23rd inst., deliver his presidential address to the members of the Concrete Institute. Other lectures in the session are as under:—

December 21st.—Prof. Henry Adams, M.INST.C.E., on "Pile Driving and the Supporting Power of Piles."

January 25th.—Mr. C. E. Peers, chief inspector of concrete works, H.M. Office of Works, on "The Concrete Aspect of Monuments."

February 22nd.—Mr. Robert N. Sinclair, on "South American Docks, Recent and of an Old Day Dock."

March 22nd.—Mr. W. Cleaver on "The Rational Design of Reinforced Concrete Wharves and Jetties, with particular reference to those for Wet Docks having a Permanent Water Level."

April 26th.—Mr. S. Bylander on "Secondary Stresses in Symmetrical Structures."

The meetings will be held at Denison House, 296, Vauxhall Bridge-road, Westminster.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have already been notified by the secretary, Mr. Alfred R. Potter, been arranged as under:—

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by [illegible] (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Municipal Monuments and Town Planning," by [illegible] (member).

Mar. 23.—"Rural Conservancy and Improvement by Means of Town Planning Schemes," by W. Rees Jeffreys (hon. member).

Apr. 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act to be passed to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ROLLER DRIVERS.—November 20th.—Hendon Urban District Council. £2 2s. per week.—The Surveyor, Council Offices, Hendon, N.W.

SURVEYOR'S TEMPORARY ASSISTANT.—November 20th.—East Barnet Valley Urban District Council.—Mr. T. A. Buckley, clerk, Council Offices, New Barnet.

TEMPORARY ASSISTANT SURVEYOR.—November 20th.—Erith Urban District Council.—Mr. H. Hurst [illegible], Council Offices, Erith.

INSPECTOR OF NUISANCES.—November 27th.—Wigton Rural District Council. £150 per annum.—Mr. J. F. W. Ritson, clerk, West-street, Wigton.

TEMPORARY DIVISIONAL SURVEYOR.—November 29th.—Somerset County Council. Mr. Gordon R. Fellowes, county surveyor, Wells, Somerset.

ASSISTANT ENGINEER.—Public Works Department, Nigeria. £300–£360 per annum. Crown Agents for the Colonies, 4 Millbank, London, S.W.

CLERK OF WORKS.—For Sandling Divisional R.E., Kent.—Division Officer, Royal Engineers, Saltwood, Hythe.

STEAM ROLLER DRIVER.—Rotherham Rural District Council. £2 per week.—Mr. R. Bradbury, Imperial Buildings, Rotherham.

SURVEYOR'S CLERK AND DRAUGHTSMAN.—For [illegible] near Salisbury, 5s. to 7s. 6d. per day.—Division Officer, Royal Engineers, Codford, Wilts.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

BRISTOL.—November 23rd.—For alterations and additions to Avonmouth sub-station, for the Electrical Committee.—Mr. H. F. Proctor, chief engineer and general manager, The Exchange, Corn-street, Bristol.

Engineering: Iron and Steel.

LEYLAND.—November 27th.—For laying cast-iron water mains, hydrants, and appurtenant works, for the urban district council.—Mr. C. J. Lomax, engineer, 37 Cross-street, Manchester.

JOHANNESBURG.—December 9th.—January 3rd.—For the supply of 1,427 house service electricity meters, seven switchboard meters, and 100 time switches, for the municipal council.—Commercial Intelligence Department, 73 Basinghall-street, London, E.C.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

DURBAN.—January 3rd.—For the supply of a 3,000-k.w. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric meters and starting panels, for the corporation Electricity Department, Dock road, Cape Town.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery, in two units, driven by suction gas or by steam, for the Ivorell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

Roads.

ROYTON.—November 22nd.—For the supply of 400 to 500 tons of non-tipper's granite setts, for the urban district council.—Mr. E. Harrison, clerk, Town Hall, Royton.

WARWICKSHIRE.—November 24th.—For the supply of road material (broken and unbroken), and tarred macadam, for the county council.—Mr. John Willmot, county surveyor, 6 Waterloo-street, Birmingham.

MITCHAM.—November 24th.—For the supply of sand for tar-spraying, for the urban district council.—Mr. R. M. Chart, clerk, *pro tem.*, The Vestry Hall, Mitcham.

CAMBRIDGESHIRE.—November 25th.—For the supply of broken granite, basalt, slag, and tarred macadam, for the county council.—Mr. H. H. Dunn, acting county surveyor, County Hall, Cambridge.

CARMARTHEN.—November 25th.—For the supply of road material and haulage, for the county council.—Mr. R. W. Jones, County Offices, Carmarthen.

WATERFORD.—For the supply of one sweeping machine, one horse scraping machine, and one stone crusher new or second-hand.—Mr. J. Bowen, county surveyor, County Offices, Dungarvan.

Sanitary.

CURRAGH.—November 23rd.—For scavenging and barrack service.—Headquarters Office, Curragh.

DUBLIN.—For scavenging and closet services.—Headquarters Office, Royal Barracks, Dublin.

Stores.

CAMBRIDGE.—November 20th.—For the supply of broken granite, syenite, basalt, or similar stone, gravel, sand, brooms, horses, carts, implements, and drivers, for the corporation.—The Borough Surveyor, Guildhall, Cambridge.

WEST HARTLEPOOL.—November 23rd.—For the supply of kerbstone, flags, channel blocks, paving setts, whinstone, pitch and tar, lime, earthenware sewer pipes, metal castings, cement, disinfectants, and cartage, for the corporation.—Mr. N. F. Dennis, borough engineer and surveyor.

FELLING.—November 25th.—For the supply of macadam, Hexworth freestone kerb, setts, whinstone kerb and setts, Portland cement, shovels, brooms, sanitary pipes, and cartage, for the urban district council.—The Surveyor, Council Buildings, Felling-on-Tyne.

KING'S LYNN.—November 27th.—For the supply of coal, oilman's goods, ironmongery, waste and packing, brushes, castings, disinfectants, stoneware pipes, timber, and plumber's work, for the corporation.—Mr. Alfred J. Smith, borough surveyor, Town Hall, King's Lynn.

NOTTINGHAM.—November 30th.—For the supply of cement, blue lias lime, red bricks, blue bricks, timber, stoneware pipes, iron castings, iron gullies, Yorkshire flags and kerbs, granite setts, broken granite, ironstone slag, chippings, river gravel, coal, picks, shovels, scoops, ironmongery, scavenging, and other brushes, disinfectants, refined tar, pitch, and creosote oil, for the corporation.—Mr. Arthur Brown, city engineer, Guildhall, Nottingham.

Pudloed Cement.—It is often noticeable that heating chambers when most required are the least efficient owing to flooding in the rainy seasons. We hear that the heating chamber of the workhouse at Selly Oak, Birmingham, which is situated in ground frequently saturated with water, was constructed with Pudloed cement, and, although built on a most trying site, good results have been attained.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* **Accepted.** † **Recommended for acceptance.**

GRIMSBY.—For the conversion of municipal hall into tuberculosis dispensary.—Mr. H. Gilbert Whyatt, borough engineer:—

Swaby & Walsham, Grimsby	£830
H. Ashton, Barton	746
M. Holmes & Co., Limited, Grimsby	719
Edwards & Raynor, Grimsby	717
E. Smith, Grimsby	713
Dewins & Goodhand, Limited, Grimsby	672
East & Graves, Grimsby	635

Engineer's estimate, £705.

SHEERNESS.—For the supply of 100 tons of 2-in. Leicester granite, 100 tons of 1½-in. granite, 100 tons of 2-in. Kentish ragstone, and 200 yds. of clean hoggin, for the urban district council.—Mr. T. F. Berry, surveyor.

	£	s.	d.
GRANITE.			
Enderby and Stoney Stanton Granite Company, Leicester (2 in.)	0	19	9
Enderby and Stoney Stanton Granite Company, Leicester (1½ in.)	0	19	6
Whitwick Granite Company, Limited, Leicester (2 in.)	1	1	0
Whitwick Granite Company, Limited, Leicester (1½ in.)	1	1	0
British Macadams, Limited, London (2 in.)	1	4	8
British Macadams, Limited, London (1½ in.)	1	4	8
Brookes, Limited, London (2 in.)	1	5	4
Brookes, Limited, London (1½ in.)	1	5	4
Cliffe Hill Granite Company, Limited, Leicester (2 in.)	0	18	3
Cliffe Hill Granite Company, Limited, Leicester (1½ in.)	0	17	9
Johnston Brothers, London (2 in.)	1	2	0
Johnston Brothers, London (1½ in.)	1	2	0
KENTISH RAGSTONE.			
Chittenden & Simmons, Limited, Maidstone, Kent	0	10	6
W. H. Bensted & Son, Maidstone, Kent	0	9	6
HOGGIN.			
J. Horsford & Co., Limited, Faversham	0	4	3
Wills & Packham, Limited, Sittingbourne	0	3	11

WANTAGE.—Accepted for the supply on hire of a 10-ton steam roller, fitted with an approved scarifier, with driver and sweeper, the contractor to supply coal, oil, and waste, together with one water-cart, providing horse and man for same, working hours 7 a.m. to 5 p.m., with ½ hours out for meals; Saturdays 7 a.m. to 1 p.m., with ½ hour allowed for meals, for the rural district council.—Mr. John W. Harris, engineer and surveyor:—

Walter W. Runcombe, Highbridge, Somersetshire.—At per day of eight hours, £2 8s. 6d.; all as per the above at per ton of stone consolidated, 2s. 2d.; breaking up road surface with scarifier at per day, £1 18s.; breaking up road surface with scarifier at per yard super., 3d.; for the provision of a second water-cart, horse and man, at per day, 10s.; for the provision of a trace horse at per day, 6s.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

21 Institution of Civil Engineers: Paper to be read, "Keadby Bridge," by Mr. James B. Ball, M.INST.C.E., 5.30 p.m.

21 Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

24 Concrete Institute: Mr. F. E. Wentworth-Sheilds delivers his presidential address. 5.30 p.m.

28 Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

DECEMBER.

5 Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

5—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.

7 Association of Managers of Sewage Disposal Works: Annual General Meeting, Holborn Restaurant, London, 2 p.m.

12 Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

21 Concrete Institute: Prof. Henry Adams on "Pile Driving and the Supporting Power of Piles." 5.30 p.m.

APPOINTMENTS OPEN.

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Divisional Surveyor, to reside in Long Ashton. Must be over military age, and be fully qualified, experienced in the maintenance of heavily trafficked rural main roads, the control of mechanical tar-macadam plant, &c. Must be used to the control of men, and the keeping of detailed accounts and preparation of estimates. Necessary to be a motor cyclist, and £30 per annum will be allowed for the provision and upkeep of a suitable machine.

Applications, stating age, experience, salary required, and accompanied by three testimonials, to be sent to the undersigned before 29th November, 1916.

GORDON R. FOLLAND,
Acting County Surveyor.

Wells, Somerset.
November 9, 1916. (3,166)

ERITH URBAN DISTRICT COUNCIL.

Required, for the period of the war, Temporary Assistant Surveyor, ineligible for military service. Applicant should hold the testamur of the Institution of Municipal Engineers, and have had experience on sewerage works, erection of buildings, road and tramway construction, and be capable to survey, take levels, prepare specification and quantities, and supervise the construction of works.

Applications, stating age, experience, and salary required, should be forwarded not later than Monday, the 20th November, 1916, to the undersigned.

HAROLD HIND,
Surveyor.

Council Offices,
Erith.
November 13, 1916. (3,169)

CLERK OF WORKS for Estate Development in the Midlands. Man capable of general supervision of building construction and road making upon an extensive scale. None need apply who are already engaged upon Government work. Send full particulars to your nearest Labour Exchange, quoting reference No. A2564. (3,167)

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We have now no casual labourers to deal with a fall of snow, but

SUTCLIFFE'S PATENT FOOTPATH & CHANNEL SNOWPLOUGH

will deal with the heaviest snowfall and will do the work of 75 to 100 men, clearing footpaths and channels at 1/- per mile. For a light snowfall

SUTCLIFFE'S HAND SNOWPLOUGH & SCRAPER

will clear snow where an ordinary plough would be useless. One man using it will do the work of three or four men with ordinary scrapers, and when not in use as a snow remover it can be used as a scraper for ordinary cleansing purposes.

Ploughs supplied to His Majesty's Government and One Hundred Authorities.

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Applications are invited for the post of Surveyor's Clerk and Draughtsman.

Rate of pay, 5s. to 7s. 6d. per day. Free single quarters.

Applications to be addressed to

Divisional Officer,
Royal Engineers,
Codford, Wilts.

(3,164)

TENDERS WANTED.

BOROUGH OF KING'S LYNN.

The Corporation invite Tenders

For the Supply during the Twelve Months ending 31st December, 1917, of the following:—

Coal, Oilman's Goods, Ironmongery, Waste and Packing, Brushes, Castings, Disinfectants, Stoneware Pipes, Timber, Plumber's Work.

Forms of Tender and further particulars can be obtained, and Samples may be seen, on application to the undersigned, to whom Tenders must be delivered not later than 10 a.m., Monday, November 27th, 1916.

The Corporation does not bind itself to accept the lowest or any Tender.

ALFRED J. SMITH,
Borough Surveyor.

Town Hall,
King's Lynn.
November 9, 1916. (3,161)

CAMBRIDGESHIRE COUNTY COUNCIL.
TENDERS FOR ROAD MATERIAL.

The above Council invite Tenders for the Supply of Broken Granite, Basalt, Slag and Tarred Macadam for use on the Main Roads during the year ending March 31st, 1918.

Particulars and Forms of Tender may be obtained from this Office, where Tenders are to be delivered on or before Saturday, November 25th, 1916.

H. H. DUNN,
Acting County Surveyor.

County Hall,
Cambridge. (3,156)

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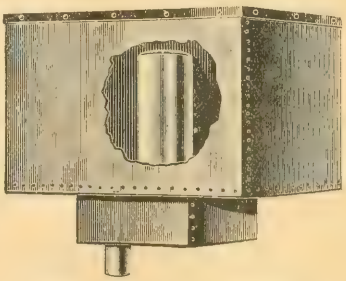

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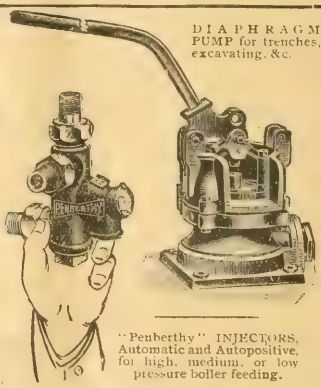

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(Works: STRATFORD MARKET, ESSEX, and GROBY QUARRIES, LEICESTERSHIRE.)

The Surveyor

And Municipal and County Engineer.

Vol. L. NOVEMBER 24, 1916. No. 1,297.

Minutes of Proceedings.

The Development of London.

Professor Adshead devoted the second of his series of lectures on the "Town Planning of Greater London after the War" to a historical and statistical survey of the present position. As far as work on a co-ordinated plan is concerned, the development of modern London may be said to have started in 1825, when there was passed "An Act for consolidating the trusts of the several turnpike roads in the neighbourhood of the Metropolis north of the river." Many years before this, however, a number of important thoroughfares had been constructed under private Acts of Parliament, and many of these are the principal roads of to-day. Thus, for example, the Marylebone, Euston, and Pentonville road was made pursuant to an Act passed in 1756, City-road was opened in 1761, and Commercial-road constructed by the East India Company in 1803. At about the same time there was considerable activity in bridge building, London Bridge being opened in 1755, Blackfriars Bridge in 1756, Waterloo Bridge in 1809, and Southwark Bridge in 1819. The construction of these bridges naturally led to developments on the south side of the river, where a number of important thoroughfares were now made under Act of Parliament by a public company. Much work of an important character was carried out by the board set up by the Act of 1825, and if we pause here to comment upon one of their mistakes, it is not because we fail to recognise the good work that they accomplished, with Macadam as their surveyor-general. Goldhawk-road was constructed in 1831 at a cost of £4,000; but, as Prof. Adshead observed, had the board decided to spend £16,000, they could have continued the Uxbridge-road direct to Turnham Green, and thus effected a great improvement that is so much needed to-day. One of the chief aims of those who are responsible for planning the future development of the Metropolis must be to profit by the mistakes of the past, and by the exercise of prudence and foresight to secure now for future generations such improvements as may be seen to be necessary.

The next stage in the history of the growth of London is clearly marked by the advent of the railway. The effect of the railway on the growth of London was at first somewhat curious, for while the town itself extended fairly rapidly by the development of such districts as Kensington, Brompton, and Bayswater, there was no great development of the suburbs. It was not until the 'sixties that the great pressure of the first residential ring was seriously felt, and this, coupled with a realisation of the practical possibility of a daily railway journey from the outer suburbs into town, led to the rapid growth of a number of new districts. In this connection it is interesting to observe that the first development of the suburbs by the railways left a loose band round London following approximately Swiss Cottage, Shepherd's Bush, Walham Green, Brixton, and Peckham, which remained for some time in its primitive state, but has since been developed. Such is the outline of the very interesting historical sketch given by Prof. Adshead. Having regard to the haphazard way in which the province of Greater London has come into being, it is indeed remarkable that present conditions are so satisfactory. To guide the development of this octopus after the war will require the greatest skill and the best brains that we possess, and the first stage in the process is undoubtedly to gain an intelligent knowledge of the history of the subject.

* * *

Migration of Population.

One of the most important parts of a complete historical survey of the growth of the Metropolis is that which is concerned with the great movements of population that have taken place, particularly in recent years. The latter part of Prof. Adshead's second lecture dealt with this subject, and the statistics which he gave are of the greatest interest. They show, of course, that all the great movements that have taken place have been the direct result of increased facilities for communication. Since 1881, when the railways for the first time commenced seriously to undertake improvements in their suburban systems, there has been an increasingly rapid growth of population in the suburbs, with a corresponding decrease in the area of the administrative county. Generally, it may be said that during the years 1891-1901 the principal migration was to what may be called the urban districts of the outer ring, such as Willesden on the west and Ilford and East Ham on the east. During the next ten years, on the other hand, a great develop-

ment of the more rural areas may be observed. But the increase does not end here. Improved railway facilities have led to large influxes of population into more remote districts such as Eton, Marlow, and the Chilterns, while large numbers of people now travel daily to the Metropolis from places as far distant as Southend, Brighton, and Worthing. Generally, it may be said that the population of the Metropolis has during the last decade diminished in the centre and increased outwards, the causes of the outward migration being the improvements that have been effected in suburban mechanical transport, coupled with an energetic development of selected areas.

But looking more intimately into this outward migration of the population we find that, although the tendency has everywhere shown a rapid increase in population throughout the outer ring, certain favoured areas have enjoyed a greater or more rapid increase than others, and that such places have not necessarily maintained the same rapidity of growth through more than one decennial period. No doubt such fluctuations are primarily brought about by the new and improved lines of communication which are constantly being introduced, and which encourage rather than arrest the restless habits of modern society, which is constantly demanding a change of residence. It is found that an attractive spot in easy communication with the Metropolis will rapidly develop, that ten years is about the limit of its first period of prosperity, and that the tendency is for newer and more attractive developments to compete seriously after ten years' growth.

* * *

Electric v. Cable Traction.

The exhaustive report recently submitted to the Edinburgh Corporation Tramway Committee by Messrs. J. A. Brodie, J. B. Hamilton, and A. H. Campbell may fairly be regarded as an authoritative pronouncement upon the present position of the problem which the authors tersely style "street transit." The question arises out of the fact that in 1919 the lease of the existing cable tramways will expire, and it is necessary to decide whether it shall be renewed or whether some other system of mechanical traction shall be employed. Edinburgh shares with Melbourne the distinction of retaining cable traction long after every other city of importance has replaced it by electric traction, and will shortly be unique in that respect, for Melbourne is preparing to electrify her cable tramways. It cannot be doubted that the fate of the cable is sealed in Edinburgh also, but the "City Beautiful" is loath to permit the trolley wire to invade the sacred vistas of the world-famed Princes-street. The authors of the report make no attempt to disguise their conviction, nevertheless, that the overhead system is by far the most appropriate system for adoption throughout the whole city; they sugar the pill, indeed, by suggesting the use of the conduit system in Princes-street, but they add a fair warning that difficulties and delays will ensue from the adoption of a mixed system, and point to the experience of Blackpool and Bournemouth, both of which towns have converted their conduit sections to the overhead system with advantage, while London, saddled with the financial burden of 120 miles of conduit tramway, would be glad to follow their example, and in fact adopts the trolley wire wherever it is possible.

Apart from the whole-hearted preference of the authors for the overhead system of electric traction as "the best, most reliable, convenient, and economical solution of the transit requirements of the city and suburbs," the most interesting feature of the report is the uncompromising condemnation of the motor 'bus as an alternative to the tramcar, which is convincingly embodied in the estimated loss to the city of nearly £40,000 per annum, as contrasted with a nett return of £66,000 if the overhead system is adopted throughout. That the motor 'buses have achieved success in London is due solely to the local conditions, which the authors describe as entirely unique—not one of the great cities of the world depends upon them as the sole form of street transit. Their advantages, however, as feeders to a tramway system in municipal ownership are recognised. As only one of the authors of the report is a tramway engineer, even the most ardent supporters of the motor 'bus can hardly allege that their adverse decision is other than impartial.

* * *

The Dublin Town Planning Scheme.

The address given by Mr. Raymond Unwin in Dublin last week on "A Town Plan for Dublin" was interesting from many points of view, and none the least from the light it cast upon the municipal aspect of the subject, and the necessity for the city council and citizens jointly dealing with the problem as one that concerns themselves mainly. While he emphasised the importance of the city council being guided by the advice of an expert in conjunction with a town planning committee, he did well to point out that the owners of property could do a great deal to settle the housing problem if they would face the facts of the situation. It is doubtless true, as Mr. Unwin remarked, that what Dublin suffers from is not that there are not sufficient houses, but that there are so few good houses. This defect, of course, applies to most towns, and especially to historical towns, but it may be said to apply to Dublin in a special degree owing to the play of economic forces. These forces are still very powerful, and there is therefore a great deal to be said in favour of the suggestion that not only the citizens of Dublin city should be appealed to with respect to the scheme of planning and housing, but that the duty is also cast upon the citizens of the suburbs to share the responsibility for the improvement of the Irish capital. On the subject of the town planning competition, which, with the question of housing is occupying the attention of civic Dublin at the present time, it should be borne in mind that the intention and object of the competition is rather to invite imaginative suggestions than attempt to reach a final result immediately. With the information at present available, it would, in fact, not be possible to reach a conclusion as regards the most suitable scheme; there are no reliable figures as to the amount of traffic in the various thoroughfares, or the distribution of the population and the value of land in the different parts of the city. Until the data with regard to such matters are collected no final scheme can be prepared. Meanwhile, it is useful to learn that the provision of houses is being proceeded with upon what, considering the difficulties of the present day, may be regarded as encouraging lines, and also that real progress is being made with respect to the re-building of the area which suffered most during the late disturbances.

* * *

Sewage Disinfection.

The extraordinary slowness with which the world in general, including the scientific world, learns may be gathered from the papers which are read before learned societies and from the written articles appearing in technical journals. It is now many years since the possibilities with regard to the sterilisation of water and sewage by means of hypochlorite were clearly demonstrated

and brought into question, and since that time onwards there have been written various papers and treatises in each of which the author brought the matter forward as if it were something quite new, to be approached with fear and doubt, and sometimes as if he personally had discovered the application of the process.

One of the latest articles upon sewage disinfection is to be found in a recent issue of the *Engineering Record* of New York. In this it is admitted that to some extent hypochlorite sterilisation has been applied to the treatment of sewage effluents, but the author shakes his head wisely over the process in exactly the same manner that his immediate forerunners treated the idea of water sterilisation when it had already become an accomplished fact. We are told that "the extension of chlorine disinfection to new fields must be made with caution," that "it has possibilities of usefulness," and that in sewage the organisms being partly enmeshed in lumps of organic matter, only the free bacteria, or those on or near the surface of the lumps, are killed. It is suggested that there are two possibilities—first, that of applying a very large dose of chlorine to the sewage, and, next, the removal of the solid matters before treatment. One is surprised to read elementary remarks of this kind. The process which is usefully adopted for the treatment of a flow of, say, 500,000 gallons of sewage a day in this country, and which has been described and discussed for years, is obviously a workable process, and the only thing that hinders its adoption is the extraordinary slowness of the world in general to accept new ideas. It has been applied with success in England and America, and where it is required it is quite workable and efficient.

* * *

Earth Pressures. After discussing retaining walls for solid earth and those for filling or made ground, Trautwine tells us that "experience rather than theory must be our guide in the building of both kinds of wall." This fact remains perfectly true in spite of the many volumes of theoretical calculations with which the engineer has been provided. It is open to question whether this would be the case if the subject of earth pressures had been more carefully studied. Calculations fail because the whole facts are not taken into account. Before we make the calculation we have to jump to certain conclusions, and without doubt these are often wide of the truth. Thus any attempt to provide the engineer with better data is something done in the right direction. Mr. A. T. Goldbeck and Mr. T. B. Smith, of the United States Agricultural Department, have devised an instrument which it is hoped will accurately measure earth pressures. This consists of a portable cell of a small size capable of indicating at some remote station the value of any pressure coming upon it. There is a small diaphragm cell and a slightly movable top, and the movement of the whole is indicated by electrical contact communicated to the outside of the earth, tested by means of a wire leading from the inside of the cell through an armoured pipe. The armoured pipe also conducts compressed air from an outside tank to the interior of the cell, and the pressure of the soil is measured by the reaction of the disc movement against this air pressure. Retaining walls are not the only structures subject to earth pressure, and this appliance, if it is found to be really a means of ascertaining the pressures of earths of various qualities under difficult conditions, should be very useful, and might eventually lead to a better comprehension of the facts which will have to be known before various theoretical calculations can be made to agree with observed practical results.

Vacant Land and Food Supply. The prominence that is being given at the present time to the question of the organisation of the national food supplies adds considerable force to the proposal for the systematic use of vacant land in towns for the cultivation of vegetables. We believe that some action in this direction has been taken in many towns, though of few, if any, can it be said—as is the case at Bognor—that "nearly all the land is now in cultivation by the allotment holders." The present satisfactory position in that town is in no small measure due to the foresight and energy of the town clerk and Mr. Oswald Bridges, the surveyor, who have done all in their power to secure that what may fairly be described as waste land in normal times shall not be wasted during the present crisis. In another column will be found a letter on the subject from Mr. Bridges, in which he sets forth for the information and encouragement of other surveyors the terms upon which land has been obtained and is being let to allotment holders in Bognor. In most cases landowners have been patriotic enough to allow their land to be used free of charge during the present emergency, and it is being let out in 10-rod plots at 6d. a rod. The real object, however, of Mr. Bridges' letter is to point out that now is the time to prepare the land for next spring, for if it be now broken up roughly it will be quite ready for planting when the season arrives. It is to be hoped that many other towns will follow the excellent example set by Bognor in this important matter.

* * *

Extraordinary Traffic Again. Questions relating to the recovery of expenses by highway authorities in connection with damage to roads by extraordinary traffic continue to arise for decision by the courts, the latest example coming from the Abingdon Rural District. The recent claim of that council against the City of Oxford Electric Tramways, Limited, is of special interest as being, so far as we are aware, the first case in which motor omnibuses have been held to be extraordinary traffic within the meaning of the Acts. A report of the judgment will be found in our issue of last week. In view of the tendency of motor omnibuses to traverse new routes in rural districts, and also of the provisions of the Local Government (Emergency) Provisions Act in regard to the subject, the decision is of great interest to rural highway authorities, by whom it should be specially noted.

Private Enterprise in Housing Reform.—At a conference on the 15th inst., in London, of over forty of the leading professional bodies of the United Kingdom concerned with the housing of the people, unanimous approval was given to the following resolution: "That this conference views with deep concern the present unparalleled shortage of houses, particularly for the working classes, which is daily increasing, and being of opinion that the original and principal cause of so grave a state of things is directly, or indirectly, due to the effects of the provisions of Part I. of the Finance (1909-10) Act as regards increment value duty, undeveloped land duty, and reversion duty, which has largely destroyed the confidence of investors in, and lenders upon, this class of property, previously regarded as the premier national security, urges his Majesty's Government to take steps at once to remove the legislative provisions referred to, and to give in every possible way their encouragement and support to private enterprise and co-operative effort in the provision of healthy dwellings for the people." It was also resolved that copies of the resolution should be sent to the Prime Minister, the Chancellor of the Exchequer, the Secretary of State for War, the President of the Local Government Board, the President of the Board of Trade, and to all other members of Parliament.

Is the Recovery of Nitrogen in Sewage Sludge Practicable?*

By WILLIAM R. COPELAND, Chemist-in-Charge, Sewage Testing Station, Milwaukee.

The answer to the question as to whether it is or is not practicable to recover the nitrogen in sewage and sewage sludge will depend upon three factors: (1) The amount of nitrogen contained; (2) the cost of recovering and disposing of the nitrogen; (3) the market value of the nitrogen.

Recovery of nitrogen, from the standpoint of this paper, had to do principally with the nitrogen in suspension, because that is the portion which appears in the greatest quantity in the sludge. The total obtained will vary both with the treatment process used and with the volume contained by the raw sewage (see Table I.).

Table I. Composition of Dry and 10 per cent Moisture Sewage Sludge.

Source of sample	Sludge obtained from	Per cent of nitrogen
On the basis of dry sludge*		
Frankfurt-am-Main	Plain sedimentation	2·85
Columbus, Ohio	Septic tank	1·40
Essen	Imhoff tank	1·22
Philadelphia	Imhoff tank	1·20
Worcester, Mass.	Chemical precipitation ...	2·77
Sludge computed on basis of 10 per cent moisture.		
Brooklyn (Williamsburg) ...	Dickson (yeast) process ...	1·4
Columbus testing station ...	Grit-chamber sludge	1·2
	Plain sedimentation tank ...	1·6
Philadelphia testing station ...	Plain sedimentation tank ...	1·2
Cleveland testing station ...	Plain sedimentation	1·4
	Septic tank	1·3
	Imhoff tank	1·2
Gloversville testing station ...	Plain sedimentation	2·3
	Septic tank	2·2
Worcester, M. & E., Vol. 3. ...	Plain sedimentation	2·7
	Septic tank	2·7
Atlanta	Imhoff tank	1·5

* From Vol. 2, Metcalf & Eddy's "American Sewerage Practice."

The gist of the data given in these tables is that the sludge which has been obtained heretofore by the best known processes of sewage treatment contained from 1·2 to 3 per cent of nitrogen. These figures are low, and show that the sludge did not possess as much nitrogen as the amount contained by the raw sewage would lead us to expect. This condition may be explained by the fact that a large share of the colloidal matter carried by the sewage ran out in the tank effluent and took nitrogen with it; or, in the case of chemical precipitation works, the lime added drove nitrogen off in the form of ammonia and diluted the portion remaining by increasing the amount of inert mineral matter. Moreover, various authors state that from 10 to 60 per cent of the volume of the solids deposited by sewage in the sludge-digestion chambers of Imhoff tanks and other forms of septic tanks is converted into soluble or gaseous form.

Much of the albuminoid ammonia is thus changed into free ammonia and free nitrogen, which escape in the liquor or bubble out at the gas vents.

Within the last two years, however, a new method of sewage purification by the so-called "activated sludge" process has been tried out in various cities of America and England. One of the distinctive features of this process is that the colloidal and suspended matters of the sewage are collected in the sludge. If this is not reaërated or overaërated, the solids are not liquefied to such a large degree as they are in septic tanks, and therefore the nitrogen does not escape.

For example—the digested sludge accumulates in Imhoff tanks at a rate of from 4 to 10 cub. yds. per 1,000,000 gallons of sewage treated, whereas by the activated sludge process 20 to 80 yds., or more, may be deposited in the settling tanks, varying widely, of course, with the strength of the sewage and the water content of the sludge.

The Milwaukee sewage testing station carried on a series of experiments during the summer of 1915, where the city sewage was treated by Imhoff and activated sludge processes simultaneously (see Table II.).

Samples of digested sludge from the Imhoff tank and of the fresh activated sludge were also collected and analysed in August and September (see Table III.). While it is not correct to say that these sludges represent all of the raw sewage passed through these tanks during August and September, it is fair to assume that they are typical of the sludge that was being produced by those processes at that season of the year.

Table II. Analyses of Milwaukee City Sewage Before and After Treatment.

Period of test, 1915.	Source of sample	Parts per million — Suspended matter	Nitrogen as Ammonia — Free	Nitrogen as Ammonia — Albuminoid	Nitrogen as Organic nitrogen	Nitrogen as Nitrite	Nitrogen as Nitrate
By Imhoff tank and by activated sludge.							
Aug.	Sewage	253	14·6	7·88	29	0·15	0·13
	Imhoff effluent...	105	16·2	6·10	27	0·19	0·13
	Activated sludge effluent... ...	14	3·8	3·19	6	0·29	6·00
Sept.	Sewage ...	300	13·5	8·81	29	0·25	0·14
	Imhoff effluent...	116	15·4	7·10	27	0·12	0·09
	Activated sludge effluent... ...	8	5·7	2·22	9	0·24	5·01

The data given in Table II. show some interesting facts. For example—the Imhoff effluent contained on an average more than 100 parts per 1,000,000 of suspended matter, whereas the effluent from the activated sludge process contained only about 10 parts per 1,000,000; the Imhoff effluent contained more free ammonia than the raw sewage, whereas the activated sludge effluent contained only one-third as much. The Imhoff effluent contained almost as much albuminoid ammonia as the raw sewage, whereas the activated sludge effluent contained only about one-third as much. The Imhoff effluent contained almost as much organic nitrogen as the raw sewage, whereas the activated sludge contained only one-third as much.

What became of the nitrogen carried by the sewage? Evidently most of the nitrogen in the sewage treated by the Imhoff tank passed out in the suspended and colloidal matters carried by the effluent. The activated sludge process, on the other hand, converted the free ammonia into nitrate, and stored up the undissolved albuminoid ammonia and organic nitrogen, as indicated by the large amount of nitrate in the effluent and high nitrogen content of the activated sludge.

Table III.—Analyses of Samples of Imhoff and Activated Sludges, Obtained from Milwaukee Sewage.

Date, 1915	Source of sample	Nitrogen reported as NH_3, on a basis of sludge dried to 10 per cent of moisture
August ...	Imhoff sludge	2·87
		3·82
	Activated sludge	5·71
		4·97
		7·04
September	Imhoff sludge	3·88
	Activated sludge	8·69
		9·00

In short, analyses of this material when dry show that activated sludge contains from 4 to 4½ per cent of nitrogen, and sludge from certain industrial plants, such as packing houses, may carry even more.

When it comes to recovering this nitrogen, however, we meet with a serious difficulty, because as the sludge gathers in the settling tanks it contains from 98 to 99 per cent of moisture, and the bulk of this water must be removed before the dry material can be sold for fertiliser.

The best information now available points to a combination of settling and decantation as a preliminary dewatering process. By this means the water will be cut down from about 99 to 96 per cent. On passing the concentrated residue through a pressure filter the moisture can be cut down to 75 per cent. The press cake can be dewatered in a drier to 10 per cent of moisture or less. More than thirty

* From a paper read before the Division of Water, Sewage and Sanitation of the American Chemical Society.

samples of activated sludge have been dewatered by sedimentation, decantation and pressing at Milwaukee.

It is an interesting and notable fact that two different types of press can handle the settled sludge without requiring the addition of lime. The sludge is not as gummy as was expected, and it presses fairly easily down to 75 per cent of moisture.

In order to try out the feasibility of further dewatering the sludge, four samples of the press cake were sent to fertiliser agents and dried there on a commercial scale. Three of these tests were made in a steam-jacketed or direct-heat drier and one in a semi-direct-heat drier. In each case the tests proved to be successful from three standpoints: (1) The sludge dried readily to a satisfactory mechanical condition; (2) the processes did not require much power; (3) little nitrogen, if any, was driven off or lost by drying. From the mechanical standpoint, therefore, the recovery of nitrogen in sewage sludge is practicable.

With regard to the question of cost, however, the situation at the time of writing is not so clear. The pieces of apparatus used for settling the raw sludge and drying the press cake were not designed to handle activated sludge in the most economical manner, but were recommended as being the best commercial apparatus available at the time.

By comparing the behaviour of activated sludge with such matters as packing-house tankage, I estimate that this sludge can be dewatered so that the recovery of the nitrogen in it will probably cost, upon present evidence, about $8 to $12 per ton of material containing 10 per cent of moisture, depending upon a variety of local factors. These figures are intended to cover interest charges, depreciation, repairs and renewals, and a liberal provision for labour and fuel, as well as the cost of resettling and decanting of the water of the original sludge, and expenses for handling, freighting and marketing the finished product. Obviously, the total cost per ton will be somewhat more in the case of a small plant than for a large one. For a very large plant, where fuel and labour are relatively cheap, it is possible that further experience will reduce the cost below the lower limit in the range here given.

Analyses of dried samples of sludge are given in Table IV. They indicate that dry activated sludge (basis of 10 per cent moisture) will contain 4·6 to 5 per cent of nitrogen fixed as ammonia, and 0·6 to 0·7 per cent of available phosphoric acid. In addition to this our data show that the dry product contains about ½ to ¾ per cent of potash and from 3 to 4 per cent of fatty material. At present prices the nitrogen is worth $2·50 per unit or per cent. In normal times this nitrogen would be worth about $2 per unit. The phosphoric acid is worth about 50 cents; and the potash may be worth something in the future, although the best that can be said of it at present is that it will assure for the fertiliser a more ready sale.

The fat present in the Milwaukee sludge is negligible. It would not pay to recover the fat, nor will the fat impair the selling qualities of the dried sludge.

SUMMARY.

Summing up the whole situation, then, we see that the dried sludge has a market value upon present figures of $0 to $15 per ton of material containing 10 per cent moisture. The total cost of getting this product and placing it on the market

TABLE IV.—ANALYSES OF COMMERCIALLY DRIED ACTIVATED SLUDGE, MILWAUKEE.

Basis of 10 per cent moisture.*

Sample No.	Character of drier	Per cent of Nitrogen as ammonia	Per cent of Available phosphoric acid
1	Semi-direct heat ...	4·56	0·70
2	Indirect heat ...	4·76	0·81
3	Indirect heat ...	4·56	0·47
4	Indirect heat ...	5·06	0·39
Average of four samples		4·68	0·57

Additional analyses for percentage of nitrogen as ammonia on the 10 per cent moisture basis showed the following results, the dates being dates samples were collected: May 3, 1916, 5·71; June 20, 1916, 4·65; June 13, 1916, 4·88; June 14, 1916, 4·92; June 16, 1916, 5·01.

will probably run from $8 to $12 commercially per dry ton, depending upon local conditions. For large plants this cost may possibly be reduced as a result of further experience.

The activated sludge containing 4 per cent or more of nitrogen is much nearer a commercial possibility than the sludges obtained by the older methods of treatment, such as chemical precipitation, septic tanks, or the Imhoff process, which the data given in Table I. indicate as contain only 1½ to 3 per cent of nitrogen.

In case the question arises as to the possibility of finding a market for the dried activated sludge it should be added that raw materials containing nitrogen, phosphoric acid and potash are capable of being worked up readily as a base for making high-grade fertilisers, and as they are not very plentiful they are in good demand.

Presumably, however, large cities, by installing this activated sludge process, would produce so much raw material of this character that the product would have to be parcelled out among a number of manufacturers. It is even possible that the production might be sufficient to reduce the price. However, the dried sludge is a good fertiliser just as it stands and contains enough value to pay for sale and distribution in quite a large local market.

DIFFICULTIES IN UTILISING BY-PRODUCTS OF SEWAGE SLUDGE.

By GEORGE W. FULLER, New York.

[In the following interesting communication dealing with the paper reproduced above Mr. Fuller shows that the greatest difficulty in the way of utilising the by-products of sewage sludge and recovering the nitrogen is the problem of dewatering. He points out that there are mechanical details yet to be studied before the process is absolutely practicable.]

Mr. Copeland's conservative statements on his observations at Milwaukee add materially to our practical knowledge on this subject. With the advent of the activated sludge method of treatment it appears, in Mr. Copeland's opinion, that the handling of sludge so as to use it in a dry form as a fertiliser has now come within the range of commercial practicability. But a careful perusal of this paper indicates that he does not entertain such views concerning the sludge obtained from other processes.

Generally speaking, the data of Mr. Copeland show that dry sludge from the activated sludge process contains about twice as much nitrogen as the sludge from other processes. His data bearing upon this matter are probably more decisive than those which have been brought together hitherto, and he explains clearly why it is that activated sludge is richer in fertilising properties than are other sludges.

Experience showed years ago that plain sedimentation removes about one-third of the total organic matter in ordinary sewages, and that chemical precipitation removes about one-half. That which is removed by these tankage treatments normally appears in the accumulated sludge. The balance passes out of the tank with the effluent. Table II. of Mr. Copeland's paper shows that with the activated sludge method the removal of organic matter is in the vicinity of 70 per cent. This seems perfectly logical in comparison with the results of plain sedimentation, owing to the fact that the activated sludge treatment removes colloids and other non-settling organic matters.

The data in this table further indicate that the Milwaukee Imhoff tanks, with their relatively short period of sedimentation, removed less organic matter by deposition than does plain sedimentation in larger tanks, as tested in earlier years.

When we consider the nitrogen content of Imhoff tank sludge—and the same would be roughly true for sludge of single-storey septic tanks—it is necessary to recognise clearly, as pointed out by Mr. Copeland, that there is a material reduction in organic matter, due to the liquefaction and ultimate gasification of organic matters in a form permitting their direct release into the atmosphere. Obviously, septicisation must mean a loss of the nitrogen content, and hence of the fertilising value of sludge.

On the other hand, activated sludge, reinforced with the nitrogen content of colloidal and non-settling matters, is not only spared the loss of nitrogen, but is actually able to show a substantial gain in nitrogen as a result of containing some of the more or less oxidised nitrogen. The removal of free ammonia, as shown in Table II., is quite striking. Part of it doubtless passes to nitrates, but it would be interesting to know what proportion of it becomes available for fertilising purposes by adherence to the solid sludge as dried.

NITROGEN CONTENTS.

Figured on a commercially dry basis (10 per cent moisture), Mr. Copeland's average figures show a nitrogen content which is compared with some other data from activated sludge tests, as follows:—

	Per cent nitrogen.
Milwaukee data (Copeland)	4·40
Manchester, England (Ardern)	4·60
Salford, England (Melling)	3·75
Urbana, Ill. (Bartow)	3·5-6·4
Armour & Co. (Noble)	4·6
English range (Fowler)	4·0-6·0

Attention is called to the fact that all of the foregoing figures are expressed in terms of nitrogen and not of ammonia, as seems to be the custom in speaking of the composition of tankage from garbage works. Nitrogen is only 82 per cent of the ammonia content, and care must be taken in dealing with the analysis. Mention should also be made of the fact that many published analyses refer to absolutely dry sludge, whereas most of the data recently refer to commercially dry sludge with 10 per cent of moisture.

From a commercial standpoint it is highly important to know whether the analysed samples of sludge are representative or not of the annual output of the plant. Where sewage from a separate system of sewers is treated, this is not so vital a matter as in the instance of the sewage from combined sewers, where the amount of mineral detritus is bound to vary materially. Obviously, mineral matter dilutes the organic sludge with inert material which, pound for pound, costs as much to dry and prepare for the fertiliser trade as in the case of organic matter free of street wash and industrial wastes.

A good deal has been written, particularly in England, as to the availability of the nitrogen content as a plant food. It is not the intent to discuss that phase here, but it would appear that the activated sludge method in this respect does not suffer by comparison with the sludge from other methods.

The availability of the nitrogen is discussed at some length in a paper by Dr. E. H. Tripp, describing the Dickson process of sludge treatment as practised at Dublin, Ireland, and printed in the Journal of the Society of Chemical Industry, May 31, 1915. In Dr. Tripp's article the nitrogen in the dry Dublin sludge is given at 2·51 and 2·26 per cent in the two analyses published. It is interesting to note that the Dublin sludge is not nearly so rich in nitrogen as that obtained without the activated sludge method.

DIFFICULTY OF DEWATERING.

It is an altogether different matter to dewater activated sludge obtained from a settling tank in a flocculent condition and mixed with 99 per cent of water from what is the case with Imhoff sludge containing 87 per cent of water and mixed with gas, so distributed as to cause practically all of the solid matters to rise and allow the withdrawal of sub-natant water.

Clearly the first step is to resettle and remove by decantation as much surface water as practicable, as described by Mr. Copeland. This, he says, at Milwaukee allows them to get sludge of about 96 per cent water content. To carry this resettling too far seems to be impracticable, owing, among other things, to the fact that the activated sludge, after settling and during storage, seems to undergo putrefaction within a period of twenty-four hours, or less. Further aëration for four or five days would make this settled sludge non-putrescible, but this treatment results in the consumption of a substantial portion of the available nitrogen.

The real problem is to dewater this resettled product. The speaker has given a good deal of attention to this matter recently, and offers comments concerning the two latter stages of dewatering, as follows:—

Mr. Copeland describes the use of Worthington presses for reducing the water content from about 96 to 77 per cent. Based on general experience, it will cost for a fairly sizable plant about $3 per ton of absolutely dry solids for pressing. For commercially dry sludge with 10 per cent moisture this figure would be about $2.70 per ton. This makes no allowances for interest, depreciation, or overhead charges.

THE DICKSON YEAST-FERMENTATION PROCESS.

The Dickson yeast-fermentation process might allow this result to be accomplished at a much lower figure, although I am not prepared to give any cost data at present. Within the past few months I have had opportunity to investigate a test plant built in Brooklyn under the eastern end of the Williamsburg Bridge for treating about 500,000 gallons of sewage per twenty-four hours, according to the Dickson process, which was originally installed at Dublin, Ireland. The sewage is subjected to plain sedimentation in hopper-bottom tanks, from which the sludge is removed at intervals and a portion of the water removed by further sedimentation. This sludge, with 92 to 96 per cent of water, is mixed with about ½ per cent of brewers' yeast and allowed to ferment for about twenty-four hours in long, narrow, round-bottom, sloping tanks, which are jacketed and kept heated to about 90 deg. Fahr. Anaërobic bacteria decompose the yeast cells and cause the sludge to become so mixed with entrained gases that the solid matters rise to the top in a manner similar to that noted with Imhoff tank sludge, and a fairly clear subnatant water is removed through a perforated pipe at the bottom of the tank. The water content of the remaining sludge averaged about 80 per cent, according to analyses made by Hill and Ferguson, but some samples showed 75 per cent, which, with improved devices, could probably be obtained regularly.

No activated sludge has been treated at this plant, which has been shut down for several weeks pending changes. It is proposed to treat activated sludge as soon as material is obtained from the Brooklyn testing station. So far as known, there appears to be no reason why activated sludge cannot be dewatered by the yeast-fermentation process in a manner similar to that experienced with the sludge of plain sedimentation tanks, as is being installed on a large scale by Mr. Watson at Birmingham, England.

SLUDGE DRYERS.

Mr. Copeland refers to both indirect-steam driers and direct-heat driers, with results which promise practical success for reducing the water content from about 75 to 10 per cent. Much weight should be attached to the fact that success has attended the drying of wet products in other industries, such as garbage tankage and refuse from stockyards, packing plants, &c. To drive off 4 lb. to 6 lb. of water with 1 lb. of coal seems to be attainable with the devices now on the market. Some manufacturers seem willing to guarantee a removal of 10 lb. of water for 1 lb. of coal. A test guarantee of 8 lb. evaporation seems reasonable, according to the conclusions arrived at in the office of the speaker, but in practice it would probably be wise to make some allowance for waste heat, which is characteristic of all plants of this general character.

Whether or not it would be worth while to use an indirect steam drier for removing a portion of the water and then finish the drying in a direct-heat type of machine is a point perhaps worthy of discussion, and upon which the speaker has reached no final conclusion.

The drier of the Dublin type, as operated at the Williamsburg test plant, did not prove very satisfactory in several respects. One of the principal difficulties was that the sludge contained more or less fibrous material, which formed lumps or balls which were not crushed by the stirring arrangements in this drier, with the result that they passed out through the outlet into the disintegrator. The water was not removed from the interior of these lumps as they left the drier, but were fairly well dried in the disintegrator. In the effort to dry out these lumps there were occasions when the sludge caught on fire, so that it would burn, and have its fertilising value lessened if the fires were put out with water, which, of course, increases the amount of coal used for dewatering.

Ripon Electric Lighting Scheme.—Ripon Corporation propose to establish electric lighting in the city at a cost of £20,000.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it not greatly to be regretted that a number of local authorities when advertising appointments still engage in the objectionable practice of asking the candidates to state the amount of salary they will require? Surely, as in a certain appointment worth a certain salary, and is it wise to ask candidates to fix their salaries when they cannot possibly know what amount of work they will be expected to perform? Does not such a practice savour of sweating? And is it permitted?

* * * *

Was it not rather interesting to note in the paper on Concrete Pavements, read by Mr. Stern at the Second National Conference on Concrete Road Building, held at Chicago, that a table of the cost per square yard of various road constructions and maintenance for twenty years showed that the most economical is concrete, costing 7·80 cents per square yard, and the most expensive, granite setts, costing 21 cents per square yard? With regard to the latter pavement, however, is not its life much more than twenty years, in which case would not the cost be much less?

* * * *

Is it not to be hoped that Brigadier-General Maybury will be able to fill the ranks of his proposed Labour Battalion in France? Are there not in this country a large number of surveyors who will be anxious to serve their country in this manner, and whose services would be of greater value in this direction than if they joined the "fighting forces," for which they have had no previous training? Will not also their local influence be of the greatest use in securing the men, of whom some thousands are required?

* * * *

Does there exist any small pocket Anglo-French dictionary which gives the ordinary road terms and names in both languages? If so, would not this be a valuable addition to the kit of the officers who are going out from this country to take charge of the companies of the Labour Battalions mentioned in the above paragraph? If such a dictionary does not exist, will some enterprising publisher consider this suggestion?

* * * *

Is not H.M. Office of Works to be congratulated on the fact that it has at last discovered a better method of road construction than ordinary water-bound macadam, inasmuch as they are finishing off the newly constructed road in St. James's Park, opposite the new Government offices, with a top crust of Tarmac?

* * * *

Apropos of the above, will this department, which has been a strong supporter of reinforced concrete construction, go one step further in road building, when they have an opportunity, and lay down a concrete road? Should not the article on this subject in last week's Surveyor tend to give an impetus to further experiments in this direction, and would not H.M. Office of Works be setting a good example if they made a trial of this method of construction?

* * * *

Is not a good example being set to other authorities by the three Welsh urban district councils who, instead of promoting Bills for the construction of tramways—now almost obsolete—have decided to seek powers in the next Parliamentary Session to run motor omnibuses? Given good roads, is there anything to prevent an almost unlimited expansion of motor traffic?

* * * *

On the other hand, has the Bognor Urban District Council acted altogether wisely in taxing motor 'buses off the road? Was it not rather stretching the pockets of the Southdown Motor 'Bus Company to "breaking point" when the council imposed a charge of 3d. per 'bus-mile, and was it surprising that the company withdrew all their omnibuses? Is there not a limit to such a tax, and is there not a great difference between 3d. a mile and ½d. a mile, which was the charge fixed by Parliament in the case of the new Great West Road out of London?

* * * *

Is it not rather remarkable that nearly all the chief provincial newspapers, and even the newly elected president of the Institution of Civil Engineers in his recent address, should be "harping" on the question of the present relations between capital and labour? Are we not in for a very bad time if some adjustment of this growing dispute cannot be made? Does not Mr. C. E. Enock try to meet some of these difficulties in his excellent book, entitled "Can We Set the World in Order"?

A COMBINED RAILWAY AND ROAD BRIDGE.

HEAVIEST LIFTING SPAN IN EUROPE.

A new bridge which the Great Central Railway Company have recently completed over the river Trent at Keadby, about 14 miles north of Gainsborough, replaces an old swing bridge which has carried the railway for about 60 years, and in addition carries a public highway in satisfaction of a long-felt want. The chief feature of the bridge—which was the subject of a paper read by Mr. J. B. Ball, M.Inst.C.E., before the Institution of Civil Engineers on Tuesday—is a lifting span, built on the Scherzer principle, and it is claimed that the structure has the distinction of being the heaviest lifting bridge yet constructed in Europe. There are two fixed river spans of 135 ft. each; a lifting span of 160 ft., giving a clear waterway of 150 ft.; a track span of 40 ft. on which the lifting span rolls, and an approach span of 70 ft. on the east bank of the river.

The bridge has a width of 53 ft. 6 in. between the centres of the outside girders, of which 29 ft. 3 in. is occupied by the railway and 24 ft. 3 in. by the roadway, each span consisting of three main girders, the centre one dividing the roadway from the railway.

The lifting span consists of three main trusses spaced at the same distances from one another as the main girders in the fixed spans, and taper from a depth of 36 ft. at the rear end to 18 ft. at the fore end. Cross girders, spaced 19 ft. 8½ in. apart, with longitudinal stringers between them, carry the deck plating of the road and railway respectively, while the upper booms of the trusses are connected together by substantial overhead portal bracing on each of the vertical posts, which, together with the wind-bracing above and the floor members below, tie the trusses together, thus securing rigidity in the span as a whole.

The lifting span is counterweighted at the rear end in order to secure balance at all angles of lift, the counterweight consisting of a rectangular steel shell extending across the full width of the bridge, and heavily braced internally by lattice frames and strengthening girders. Its internal capacity is 24,780 cub. ft., and it contains 1,800 tons of concrete.

Between the rear ends of the trusses and the under side of the counterweight, compound plate-web segmental girders having a radius of 28 ft. are provided. These girders have a central depth of 10 ft., and on their bottom flanges are bolted segmental plates of forged steel 3½ in. thick, provided with slots to engage with the teeth of the track plates on which they roll.

On each side of the lifting span heavy frames are built up alongside the track girders and anchored down to the supporting piers of the bridge. These frames at their upper extremity carry horizontal girders, to which are bolted the main operating racks. Between these frames sufficient clearance allows the span to move freely as the bridge is raised or lowered.

The total weight of steelwork in the lifting span is 987 tons, exclusive of the machinery and gearing, and the total weight of the moving span, together with its counterweight, is approximately 2,920 tons.

The lifting span is worked electrically by means of two 115-h.p. direct-current motors, carried on the leaf itself, the power being transmitted through trains of gearing to the main pinions on each side. The angle of maximum elevation of the bridge when fully open is 81°51, and the time taken to open or close it by electrical power is less than two minutes.

In order to meet the requirements of the Navigation authorities, the lifting span was erected in a vertical position, ten months being occupied in this work.

Water Waste.—At a meeting of Liverpool Water Committee on Tuesday, Colonel Porter, the chairman, said the recent appeals to the public to minimise wastage appeared to have borne fruit, and it was particularly desirable at the present season, when frost and consequent increased waste might be expected, that those efforts should be continued, and, if possible, intensified.

Ferro-Concrete Bridges on the Meuse.

A few miles north of the picturesquely situated town of Dinant, which was a favourite resort of tourists before the war, is Bouvignes, one of the most ancient towns in the Meuse Valley, formerly occupied in the conduct of constant feuds with Dinant, and now somewhat resembling one of the "dead cities" of Holland, in the respect that it has dwindled down to a mere village.

The ruined tower of Crève-Cœur is a conspicuous object reminiscent of the ancient importance of the place, and the fine bridge is equally prominent as an example of modern developments in engineering science.

The bridge, constructed entirely in Hennebique ferro-concrete, was completed about seven years ago. Having a total length of 395 ft. between abutments, the bridge comprises three arch spans, two of 135 ft. at the ends and one of 107 ft. at the centre.

Bridge at Bouvignes, Belgium.

The roadway, bordered on each side by a footpath, is paved with asphalt laid directly on the ferro-concrete decking, thus conducing to the elasticity of the way for vehicular traffic.

The river piers supporting the arches are founded on solid rock by means of ferro-concrete caissons, the walls of which are braced internally by members of the same material. The caissons were constructed entirely above water level and sunk after the concrete had hardened sufficiently by means of eight screw-jacks mounted on timber framework erected around the site of each pier. In the place to be occupied by each caisson, two layers of concrete in bags were laid upon the rocky bed of the river and carefully levelled by divers to form suitable bases for the caissons, which were lowered by the jacks, operated so as to keep the caissons perfectly horizontal during their descent.

After having been sunk in position the caissons were filled up with coarse concrete, and upon them were constructed the ferro-concrete piers. The caissons measure 20 ft. high, approximately, from foundation level to the top, the latter being about 3 ft. 6 in. above normal water level.

The foundations of the abutments were executed on the Compressol system, by means of which a series of concrete piers were formed in the hard gravel on the banks of the river. The abutments themselves were constituted by cellular structures of ferro-concrete filled with coarse concrete and large pebbles from the river.

As shown in the accompanying photographic view, the arches are of the open spandrel type, and the whole of the reinforcement was disposed in accordance with standard Hennebique practice.

ROUILLON BRIDGE.

The first Hennebique bridge constructed on the river Meuse was completed about ten years ago at Rouillon, 7 miles from Dinant, in one of the most attractive parts of the Meuse Valley. On the precipitous heights above are the Chateau Hestroy, the towers of the sixteenth-century castle of Bioul, and the ominously named Château Hun.

The new bridge has a total length of 492 ft., comprising four arch spans, three over the main channel of the river, 125 ft., 138 ft., and 125 ft. respectively, and one of 57 ft. 6 in. for flood waters.

The roadway and footpaths are laid on ferro-concrete decking, supported by means of spandrel columns on the main arch ribs, springing from abutments at each end and three intermediate piers, two of these being in the river.

Three methods of construction were employed concurrently in the execution of the foundation work. Thus, the abutments embody an application of the Compressol system; the intermediate pier on the left bank was founded on a concrete base constructed in an open excavation, and the river piers were built up from ferro-concrete caissons.

The foundation of each abutment includes eleven large ferro-concrete piles, passing through alluvial soil and loose gravel to a bed of hard-pan overlying the rock formation of the valley. The cavities occupied by the piles were made by the falling weights of a Compressol machine, and the concrete is reinforced by vertical steel bars emerging at the top and embedded in the concrete of the pier above, thus effecting a metallic bond in addition to that constituted by the monolithic connection of the concrete.

The foundation of the pier on the left bank was formed in an open excavation carried down to a bed of hard gravel, the concrete being mixed with sand and pebbles from the river bed. The base was levelled off about 20 in. below the ground, and from its upper surface projected ten vertical bars of steel, furnishing a bond between the foundation and the body of the pier.

Bridge at Rouillon, Belgium.

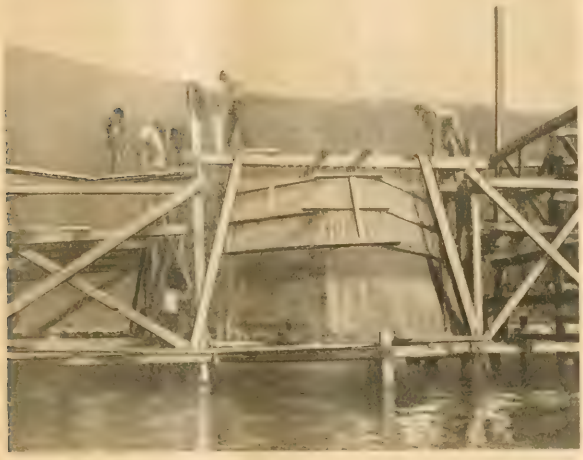
The two river piers exemplify the caisson method of foundation work. The caissons were open at the bottom, and after construction were sunk and adjusted in position on previously levelled beds on the rock bottoms of the river. Then sufficient concrete was deposited under water all around the inside perimeter of each caisson to form a continuous layer, 3 ft. 3 in. thick, effectively sealing the joint between the bottom edge of the caisson and the rock bed.

After this concrete had been allowed to harden for eight days, the interior of each caisson was pumped dry and filled completely with concrete. The caissons were formed by outer walls of ferro-concrete, 7·87 in. thick and reinforced near both surfaces, braced by four transverse beams. The horizontal section of the caissons is elliptical, the dimensions

being increased progressively as the bottom is approached. The major and minor axes of the caissons are 26·24 ft. and 13·12 ft. at the top, and 34·44 ft. and 21·32 ft. at the bottom, the height of each caisson being 17 ft. over all.

Each caisson was moulded directly above its final position on timber framework and lowered into place, after the concrete had hardened sufficiently, by means of eight wire cables attached to an oak beam moulded in the concrete of the exterior walls, the cables being led from eight 12-ton screw-jacks on the supporting framework. In the view reproduced herewith is shown one of the completed caissons in the act of being sunk.

To obviate excessive strain on the suspension apparatus and to facilitate operations the caissons



ROUILLON BRIDGE SINKING A PILE CAISSON.

were constructed and lowered in two stages. When the caissons had been moulded for half its height, the work was covered about 6 ft. 6 in., and the upper portion was then moulded. The height of the caissons was predetermined so as to bring the upper surface about 18 in. above water level, in order that there should be no risk of inconvenience or delay from fluctuations of water level in the river. All the vertical bars of the reinforcement were made of length sufficient to enable them to be continued into the pier above.

After completion of the abutments and piers, the arch spans were taken in hand and the necessary centring was designed so as to leave two openings for navigation throughout the execution of the contract.

HERMALLE BRIDGE.

Travelling from Liege by the Nord-Belge railway at times of peace, the valley of the Meuse is extremely picturesque and attractive in spite of numerous indications of the industrial activity of the inhabitants. One of the most pleasing places is Hermalle, about 12 miles from Liege. Here the river is spanned by a very fine ferro-concrete bridge with four graceful parabolic arches, completed in 1909 from the designs prepared by the Messrs. Hennebique, of Paris, under the superintendence of the Government Department responsible for harbours and bridges.

The total length of the bridge is 584 ft., and it includes three river arches of 157 ft., 167 ft., and 151 ft. span, respectively, in addition to an arch of 98 ft. span to carry over flood waters. The structure was planned to come in with a scheme to be executed later for the reclamation of the right bank of the river, and to provide for a towpath 10 ft. 8 in. wide on each side, under the end river spans. The rise of the arches varies from $\frac{1}{7}$ to $\frac{1}{8}$ of the span, and the clear headway for 30 ft. on either side of the crown is 25·41 m. above normal water level. The foundations were executed on the Compressed system, the ferro-concrete foundations, abutments, piers and arches being in monolithic connection throughout. Each span consists of an arch ring, from which rise spandrel columns for the support of the roadway decking, the latter merging into the arch ring near the crown. The bridge provides for a roadway and two footpaths, the gradient being 1 in 40.

Completed in the short space of five months, the bridge cost £660 less than the estimated value of a steel structure, and as maintenance charges are practically *nil* the ultimate saving will be very much greater.

On completion the work was tested under a dead load of 80 lb. per square foot and a rolling load of 70 tons in addition, the resulting deflection being exceedingly small and of purely elastic character.

BRIDGE AT HERMALLE.

Housing at Greenock.—The formal opening took place on Tuesday of the Craigeknowes cottage scheme of the Greenock Corporation. The West of Scotland Building Company, the contractors for the work, are now engaged in erecting the fifteenth of the 106 houses comprising the scheme, and hope to hand over numbers for occupation at frequent intervals in the near future. The proportion of houses is thirteen to the acre, and the rental about £23, excluding rates, the Admiralty having advanced a bounty of 12 per cent on the total cost. The houses are built on the semi-detached principle, in blocks of two and four, and consist of three bedrooms, living-room, scullery, bath-room, &c., with electricity throughout, and gas for cooking purposes. When the scheme is completed the corporation will be the owners of 539 houses. As soon as the war is over and the corporation are enabled to borrow money, another scheme, if possible an improvement on the present, will be carried out in another part of the town.

Getting Rid of a Toll Bridge.—The Abergele Urban District Council, at its meeting on Monday night, discussed the scheme put forward by the St. Asaph Rural District Council for the freeing of a toll bridge at Foryd Harbour, which connects Flintshire with Denbighshire. The members (reports the *Liverpool Post*) generally supported the scheme, but said they did not consider that Abergele should be called upon to give any financial assistance, as they would have to pay the increased cost of road repairs in the county rates if the road from the bridge was mained. They considered that the Rhyl Council should pay the whole of the cost of buying the bridge, seeing that for years under a special order the whole of the bridge is in the Rhyl district, and that town had taken the rates. It was hard that the private owner of the bridge should take all the tolls, and yet pay no rates to Denbighshire, in which county there was a lengthy piece of road leading to the bridge. It was also hard on farmers taking produce to Rhyl that they should have to pay toll and yet receive no contribution from the bridge towards the upkeep of the road. It was decided to give the scheme moral support.

ROAD DAMAGE BY MOTOR VEHICLES.

THE LIMITATION OF LOADS, SPEED, AND SIZE.

In a paper read before the American Society of Municipal Improvements, Mr. Eugene W. Stern, M.CAN.SOC.C.E., chief engineer in charge of highways, Borough of Manhattan, expresses the view that regulations properly framed to protect the pavements against the destructive effects of excessive loading in vehicles should take into account the following factors:—

(1) That the wearing or damaging effect of wheel loads on pavements is a function of (*a*) the load; (*b*) the diameter of the wheel; (*c*) the width of tyre; (*d*) whether or not the tyre is of a resilient material such as rubber, or of steel; (*e*) the kind of springs.

(2) That speed has much to do with the damaging effect of heavy loads.

An investigation of the laws and ordinances governing the weights and loads of vehicles, &c., adopted by eight states and forty-nine cities in the United States and Europe, went to show that only a few laws had been drafted in accordance with modern conditions. It was surprising that even to-day certain communities required that the width of the tyre should depend on the diameter of the axle, regardless of the loading; others made no distinction in the regulations between a wheel large or small in diameter, while still others treated rubber and steel tyred wheels the same.

Mr. Stern quoted as among the most up-to-date ordinances the following:—

Chicago, Ill.—Maximum weight of vehicle, 15 tons; maximum load on any one axle, 12 tons; maximum load on the wheel, 6 tons; maximum load per inch width of tyre, 1,000 lb.; maximum length, 40 ft.; maximum width, 8 ft. 6 in. Speed, compatible with safety, but not to exceed 9 miles per hour; not to exceed 4 miles per hour when truck has defective tyre which would cause injury to pavement. Motor trucks must have rubber tyres. Trailers may have steel tyres.

New York State.—Maximum weight of vehicle, 14 tons; maximum load on any one axle, 9 tons; maximum load per inch width, 800 lb.; maximum width, 8 ft. 4 in. (except traction engines, which may have a width of 9 ft. 2 in.). Speed—over 4 tons, 15 miles per hour; over 6 tons, 6 miles per hour, with steel tyres, 12 miles per hour with rubber tyres.

State of New Jersey.—Maximum weight of vehicle, 12½ tons; maximum load per inch width of tyre, 800 lb. Speed—4 tons, 12 miles per hour (iron tyres); 6 tons, 8 miles per hour (iron tyres), 10 miles per hour (rubber tyres).

State of Pennsylvania.—Maximum weight of vehicle, 12 tons; maximum load on any one axle, 9 tons; maximum load per inch width of tyre, 750 lb.; maximum width, 7 ft. 6 in.; for 'buses in large cities, 8 ft. 4 in.

State of Massachusetts.—Maximum weight of vehicle, 14 tons; maximum load per inch width of tyre, 800 lb. (except for hard pavements). Speed—4 tons, 15 miles per hour; 6 tons, 6 miles per hour with iron or steel tyres, 12 miles per hour with rubber or similar tyres.

Oakland, Cal.—Maximum weight of vehicle, 14 tons; maximum load per inch width of tyre, 800 lb. (except for hard pavements). Speed—4 tons, 6 miles per hour with iron or steel tyres, 12 miles per hour with rubber tyres.

England.—The English had much the most complete and scientific ordinances of any that the writer had examined. Maximum weight of vehicle, 12 tons; maximum load on any one axle, 8 tons (for trailers, 4 tons); maximum weight of vehicle, without load, 5 tons; combined weight of motor car and trailer, 6½ tons; weight on axle to be proportioned to diameter of wheel. The load per inch width of tyre (steel) shall be 840 lb. for wheels 3 ft. in diameter, and an additional allowance of 9½ lb. for every additional inch in diameter beyond 3 ft., and for wheels less than 3 ft. in diameter a deduction of 18⅔ lb. per inch width of tyre for every inch less in diameter than 3 ft.

Vehicles for military service limited as follows: Weight of car unladen, 6 tons; weight of car with trailer, 8 tons; unit of registered axle weight, with tyres shod with cross-bars, 560 lb.; maximum width, 90 in. for 3 tons; 90 in. for trailer. Speed—dependent on axle weight for iron-tyred vehicles; 6 tons, 12 miles per hour for rubber tyres; over 6 tons, 8 miles per hour for rubber tyres. Should car unladen weigh more than 3 tons, speed is limited to 8 miles per hour. If motor draws trailer, maximum speed is 5 miles per hour.

WIDTH OF VEHICLES.

The writer of the paper urged that unless some limitation was placed upon the size of vehicles, the tendency would be to make them larger and larger, until they would become a nuisance and congest the highways. This was now becoming evident in New York, as well as in other cities.

In order to provide reasonable standing room on each side of a street and at the same time allow traffic to proceed in both directions, they were forced to limit the width which vehicles took up.

Many of their streets had roadways only 30 ft. between kerbs. It thus became evident that vehicles over 7 ft. in width did not allow for two to pass, even using the utmost care. While it was becoming necessary to widen roadways in the borough, it was very difficult to add more than 2 ft. to each side—a 30-ft. roadway was thus converted into a 34-ft. roadway. In this case a 7½-ft. width for a vehicle would be the limit.

In conclusion, the writer submitted that the subject was one of paramount interest to all cities, and that the time had now arrived when the issues must be squarely faced.

MILITARY AND PUBLIC PARKS.

A NORTHAMPTON COUNCILLOR'S COMPLAINT.

At the last meeting of the Northampton Town Council, Councillor Rogers drew the attention of the council to the use of the Racecourse promenade by the military for their horses. The promenade was used largely by the public, and it did not seem right to him that the military should use it as they were using it now. He was told also that the public was being somewhat incommoded by bayonet practice in the Paddock in Abington Park. He was anxious that every facility should be given to the military authorities, but he thought if their attention was drawn to these matters they would be avoided.

Alderman Brown said the bayonet exercise was done by a small squad of men, and was the finishing touch of their training before they went to the Front. Few people were about at the time, and in the circumstances he felt he could not stop them. Military exercises should be done in the large park, but that was fully occupied by troops at drill.

Councillor Catt said the military were partitioning off a portion of the promenade, and would be using half the promenade this week.

The borough engineer (Mr. A. Fidler) said a communication from the military authorities would be before the Estates Committee on Friday, in which they stated it was absolutely necessary to use a portion of the promenade. If they did damage, which was undoubted, because of the light construction of the promenade, they would reinstate on leaving.

Councillor Rogers also mentioned a complaint made in a letter to the *Northampton Echo* that trenches are being dug in a prepared playing pitch at Far Cotton Recreation Ground. Alderman Brown said the trenches were dug in exactly the same spot as before; they were dug with the consent of the Parks Superintendent, and there was nothing wrong there.

"AN UNPATRIOTIC COUNCIL."

Subsequently Councillor Kirby moved the deletion of the recommendation of the Estates Committee that the military be charged a rent of £1 5s. per week for the use of the Grand Stand on the Racecourse as a hospital. He regretted that the proposals should be made to charge for hospital accommodation for the wounded.

The Mayor: There is no seconder, so it falls to the ground.

Councillor Kirby: A very unpatriotic council.

Land for Cottages in Surrey.—"How is it possible for public bodies to take up the housing question if they are met in this way by the landowner?" asked Mr. Arthur Spurgeon at the Surrey County Council, in connection with a committee's recommendation that land for two police cottages at Merstham should be bought from Lord Hylton at a price representing £1,306 per acre. The Standing Joint Committee contemplates the expenditure of £11,900 on police stations and cottages after the war. The committee's recommendation was withdrawn, and Sir Charles Walpole, the chairman, said he hoped that a more satisfactory arrangement would be possible.

Sewage Treatment by Aëration and Activation : The Development of the Process.*

By GEORGE T. HAMMOND, Engineer-in-Charge of the Sewage Experiment Station, Bureau of Sewers, Brooklyn.

(Conclusion.)

There are two activated-sludge plants in Chicago. The first, which is the larger, was installed by the sanitary district in January of this year. So far, the results have been negative, owing mainly to trouble caused by the porous plates used to diffuse the air. Mr. Langdon Pearce thinks that we should go slow in the adoption of this method. It is not a simple process to operate, but one whose entire limitations are not yet developed. The cost problem is still uncertain, particularly the cost of handling the sludge.

The other Chicago plant is that of Armour & Company, soon to be demolished, as its work is about completed, and a permanent plant of large size is to be installed for the stockyards. This is an experimental plant, having, with an eight-hour retention period, a capacity of 30,000 gallons per day. The sewage treated, derived from the stockyards, carries at different times from 58 to 3,000 parts per 1,000,000 of suspended matter. For air distribution porous plates were used at first, but gave trouble and were soon abandoned, pipe grids being substituted, which could easily be removed and cleaned, and these have given full satisfaction. The pipes are 1-in. galvanised pipe, and are perforated with 1/25-in. holes, staggered, 2 in. apart. Mr. G. L. Noble writes of this plant:—

"We have been operating constantly since last February, and feel more surely than ever that activated sludge will probably be the cheapest and most efficient method of sewage disposal for our particular needs. . . . We are now installing an experimental plant at Fort Worth, Texas, to use on our sewage down there. We are still experimenting with dewatering the sludge, concerning which our conclusions are not yet final."

At Chicago about 25,000 gallons of sludge, 99 per cent water, is produced per 1,000,000 gallons of sewage. This gives about 1¼ tons of dried material containing 4½ units to 5 units of ammonia, the value of which gives the sludge a value of $9 to $10 per ton in the dry state.

MILWAUKEE.

Perhaps the most interesting as well as the largest activated-sludge plant in this country is that located at Milwaukee, Wis. After extensive experiments, in which Dr. Gilbert Fowler, of Manchester, England, cooperated, this plant was constructed and put into service in January of this year. Its nominal capacity is 1,620,000 gallons per day, but, owing to the settling basin having proved insufficient in capacity, not more than 1,200,000 gallons can be properly treated. Additional settling capacity is being, or already has been, provided, which will bring the plant up to its designed capacity.

Much trouble has been experienced with the porous plate air distributors and the soundness of the material of which they are formed. The porosity runs from 1·85 cub. ft. to 4·50 cub. ft. of air per minute per square foot of surface, under 2 in. of water pressure. The air filter is not yet entirely satisfactory, and permits some oil and dust to enter the plates, which results in some plates working more freely than others, and the uneconomical use of air. These seems good reason to believe that these difficulties will soon be overcome, as they are only questions of experiment and design.

Cold weather has been found to increase the amount of air necessary, and to decrease the nitrates in the effluent, but in February, March, and April 98 per cent of suspended matter and 95 per cent of bacteria were removed, and a stability secured of 108 hours without dilution.

The dewatering of sludge has been successfully done with either of two kinds of presses. The sludge which contains 99 per cent water is reduced to 75 per cent water without difficulty, and further dried by a direct or indirect heat drier to 10 per cent moisture.

As to the value of the sludge recovered, this is stated to be about $12·50 a ton of dry material, on the basis of 5 per cent of available ammoniacal nitrogen, which is worth about $2·50 per unit, each per cent being taken as a unit. This does not include phosphoric acid or potash, of which the combined value may be from $1 to $2 in each ton.

Milwaukee is so situated, and the cost of electric power, stated to be about 6/10 of a cent per kw.h., is so low, that the activated-sludge method seems particularly well adapted to the place, and problems of design now seem to be the principal problems to be met.

BALTIMORE.

At Baltimore, Md., activated-sludge experimental work has been progressing with many difficulties, caused mainly by the form of air compressor at first installed. The oil used to lubricate this got into the porous diffusers, which gave considerable trouble, and was not prevented by the interposition of a gravel strainer in the air line.

The outstanding fact, writes Mr. Frank, is that, thus far, the experiments have not been successful in demonstrating the feasibility or economy of the process under existing experimental conditions.

In October, 1915, the idea suggested itself, Mr. Frank states, that some form of preliminary treatment might possibly be of advantage. The relation between the biologic oxygen demand of the sewage and the amount of compressed air necessary, it would seem, should bear an almost arithmetical relation to each other. Imhoff tank treatment, exclusive of the cost of drying sludge, may be estimated roughly at $1 per 1,000,000 gallons for the average municipality. It is estimated that air alone cost in Milwaukee $4·45 per 1,000,000 gallons of sewage, this being on a basis of $2·50 per 1,000,000 cub. ft. of air. Imhoff tank treatment would need to reduce the oxygen demand only 22·6 per cent before it began to assume importance. The activated sludge might also thereby be considerably reduced. Estimates from experiments indicate that, instead of producing one volume of sludge to 104 volumes of sewage, which was true of the unsettled sewage, there was produced only one volume of sludge for 525 volumes of settled sewage. It is questionable whether activated sludge can be as economically disposed of as Imhoff tank sludge.

Much trouble has been experienced, both with the compressor and with the porous discs. A new compressor has recently been installed and a very ingenious arrangement and design of the disc diffuser has been adopted.

The work at Baltimore may be said to have just started anew with much promise.

TEXAS.

At Houston, Texas, the experiments have been discontinued and the new plant is under construction. This plant will have a capacity of 18,000,000 gallons per day. The sludge will be applied to land for the present; no definite plan for dewatering the sludge has been adopted.

At San Marcos, Texas, an activated sludge sewage disposal plant is in regular service and is doing satisfactory work. The aërating tank is of concrete, 10 ft. deep. It is practically a channel 4 ft. wide and 160 ft. long, divided into four sections, each 40 ft. long. There is a single row of filtros plates down the centre of each section, spaced 3 ft. on centre, with each plate in the bottom of a hopper; a Connersville blower supplies the air, which is under 5 lb. pressure. It requires only 4 kw. of current to drive this blower. Much trouble has been experienced with the porous plates; some clog, others break. The plant is operating with about 150,000 gallons per day at present, giving an effluent always clear and sparkling, with a relative stability of 99 per cent, according to the methylene blue test, and with a bacterial removal of 98 per cent. The plant is free from odour. The work of this plant is reported as satisfactory, except the trouble with the porous air diffusers. Sludge will be too small

* Paper presented at the annual convention of the American Society of Municipal Improvements, held at Newark, N.J., on October 11th.

a quantity to make dewatering pay. It will probably be disposed of on land.

CANADIAN EXPERIMENTS.

The activated sludge plant at Edmonton, Alberta, Canada, has recently been put into service. Mr. A. W. Haddow, acting city engineer, states that, as this plant was designed eighteen months ago, when very little was known about the activated sludge process, and as the plant was not solely for experimental study, the precaution was taken of building an Imhoff tank alongside of the aërating tanks. The plant treats the sewage of 4,500 persons. The sewage amounts to 33,000 cub. ft. per day. The plant has many interesting features. Air is obtained from a Connersville high-pressure blower, which has capacity to spare for the one tank now in operation.

Air distribution is by means of a grid or grill of iron pipe. The tank under experiment has four 1½-in. down pipes, with a valve on each pipe. The pipes are placed 30 in. on centres, and branch into two 1-in. air-distributing pipes at the bottom of the tank, one running towards each end, where they are plugged. Each down pipe, with its valves, is an independent unit, and by unscrewing the Dart union it can be lifted out for examination without interfering with the blowing on the other pipes. The air-distributing pipes are supported from channel irons by means of ⅜-in. rods. In the bottom of the tank there are four lines of these 1-in. pipes, laid 30 in. apart, and perforated on the underside with ⅛-in. holes, separated 3 in. This gives an excellent distribution of air.

Each of the down pipes above mentioned, which carry the air to these grills, is so connected below the valve and above the Dart union at the top with a 3-in. high-pressure water pipe, that it and the distributing pipe can be flushed out. In addition to this, by shutting off the water from the high-pressure pipe and turning on steam, the grills can be steamed out, if they become clogged with grease or oil. A check valve is placed in the main air feed line to prevent water getting into the blower in case of carelessness in operating the valves.

The motor is 15-h.p., belt-connected, a.c. 60-cycle, 3-phase. The power consumption at low speed is 4 kw. per hour.

The whole plant is housed in, on account of low temperature in winter. This plant at present operates on the fill-and-draw plan, but can easily be made to operate on the continuous flow plan later.

Experiments have been conducted at the city of Regina, Saskatchewan. Mr. J. Russell Ellis, acting city engineer, writes that the idea in starting was to obtain data on the adaptability of the process, after which a plant might be designed for the whole city, if the experiments were successful. The results indicate that the process is adaptable to local conditions, and consideration is being given to the design of a large scale unit. Air distribution was effected by means of perforated pipes, covered with canvas.

UNSOLVED PROBLEMS.

It is notable that in the midst of our enthusiasm for the activated sludge method of sewage treatment a studious reserve is maintained in every paper describing experiments as to the general outlook. There are many unsolved problems, all acknowledge, and as yet there is need of caution. It is now nearly two years since the method was announced, and studies have multiplied relative to it. What, may we ask, is the present status of the method, and what are the main problems as yet unsolved or not completely solved?

At the annual convention of the American Society of Civil Engineers an informal meeting of those interested in sewage disposal was held, which was attended by thirty-two members of the society. The purpose of the meeting was stated by Mr. T. Chalkley Hatton, of Milwaukee, as follows:—

(1) To discuss the problems connected with the treatment of sewage by the activated sludge process.

(2) To compare results obtained from the several experiments carried out in the United States and Canada.

(3) To harmonise those results with a view of determining the causes for the variance.

(4) By co-operation to determine, if possible, the following questions:—

(*a*) Most efficient depth of aërating tanks.

(*b*) Most efficient type of aërating tank, embracing (1) baffles, (2) unbaffled; (3) bottom cross-section, (4) circular or rectangular.

(*c*) Most efficient method of diffusing air, embracing (1) open air pipe; (2) perforated or woven metal discs, (3) stoneware; (4) wood plates.

(*d*) Probability of diminishing efficiency of air diffusers, and consequent necessity for providing appliances and facilities for cleaning same at intervals.

(*e*) Most efficient type of sedimentation tanks, embracing vertical flow and horizontal flow and probable velocity in each to effect satisfactory precipitation.

(*f*) Best method for removing sludge from sedimentation tanks and regulating the volume to be returned to the aërating tanks.

(*g*) Volume of dry sludge (10 per cent moisture) secured per 1,000,000 gallons of sewage treated.

(*h*) Removing surplus sludge from sedimentation tanks and dewatering. (1) subsequent settlement under water pressure; (2) pressing; (3) centrifuging; (4) fermentation; (5) absorption; (6) natural drying; (7) artificial drying.

(*i*) Marketing sludge.

(*j*) Standardisation of terms in the activated sludge process with a view of comparing results, embracing (1) air used, and its measurement; (2) diffusion area; (3) volume of activated sludge; (4) quality of activated sludge; (5) volume of surplus sludge removed; (6) putrescibility and stability of sewage and sludge; (7) such other standardisations as may seem desirable.

The question was discussed of effecting a permanent organisation for systematically co-operating in solving the several problems of the activated sludge process so as to avoid duplication of experiments throughout the United States and Canada, and also to protect the process from being controlled by patents issued without complete information having been submitted to the Commissioner of Patents by those who had knowledge of the process prior to the application for letters patent.

It was finally decided that this was not the proper time for effecting such an organisation; that the objects sought could best be obtained for the present through a committee and individual service, and a committee composed of Messrs. F. A. Dallyn, provincial sanitary engineer, Toronto, Canada; George T. Hammond (the author), engineer of design, borough of Brooklyn, and T. Chalkley Hatton, chief engineer, Sewerage Commission, Milwaukee, was appointed for the following purposes:—

(1) To prepare standard definitions and other terms relating to the activated sludge process of treating sewage.

(2) To tabulate and distribute a summary of work now being done, or contemplated.

(3) To suggest such correlation of the work being done as may from time to time be desirable.

The foregoing will give some idea of the amount of work which remains to be done and experimentation carried out before we are entitled to claim that we have reached a complete solution of the problems involved in the activated sludge process.

Taking a broad view of the field, it is of much interest to observe the work being done by the many investigators and scientists who are making a study of this method of treating sewage, and the outlook is quite encouraging, the more so as it is seen on every hand that the problems, both scientific and practical, are well recognised and are receiving careful study.

The Hull Water Carriage System.—Mr. Edward Leonard, an inspector of the Local Government Board, sat at the Hull Guildhall recently to hear a number of appeals against the decision of the Hull Corporation in the matter of the expense incurred by them in providing and fixing water-closets. The cases were those in which the corporation had substituted water-closets for the existing privies, and had charged the owners with the cost. Objection to the charges was made by the Hull and District Property Owners' Association on the ground that the accommodation in the properties affected was sufficient. On behalf of the corporation the town clerk argued that common sense must be applied to the situation as it existed. But the opposite of sufficiency was insufficiency, and he submitted that if they found pails were allowed to go on leaking month after month, and if they found in addition that in order to empty their contents these leaky vessels had to be carried through the dwelling-house, no sensible person, applying the ordinary rules of common sense, could say that the accommodation was sufficient.

The Surveyor
And Municipal and County Engineer

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SOME RECENT PUBLICATIONS.*

THE CONSTRUCTION OF ROADS AND PAVEMENTS. By T. R. Agg, Professor of Highway Engineering, Iowa State College. Price 12s. 6d. nett. London: Hill Publishing Company, Limited.

This book is another American contribution to the subject of road construction, which of late years has developed from a more or less "rule-of-thumb" affair to a scientific study, in which the American engineers have taken a keen interest. The book is divided into twelve chapters, dealing, *inter alia*, with such matters as earth roads, sand-clay roads, brick pavements, concrete roads, and other questions which do not directly concern English practice, but, in addition to this, there is given a great deal of information with regard to surveys and plans, and the design of rural roads, which is most useful. The chapter on testing non-bituminous road materials is an excellent epitome of the methods adopted for such tests, and gives a good deal of useful detail.

There are a number of diagrams of cross-sections of roads of various construction, and it is rather remarkable to find that the American practice appears to be not to steer when the haunches of the roads, but to make them thicker in the centre, tailing off towards the sides. This does not seem to be good practice, as the tendency of most roads is to spread towards the sides, which, unless strengthened to prevent this, leads to disastrous results.

Although hitherto we have not been very successful in this country with the construction of concrete roads, the chapter on this subject is well worth perusal, as it is evident that to secure success with this class of road great care in construction is necessary, and if the advice and details given by Mr. Agg in this chapter were followed, probably our failures hitherto would be changed into successes.

It is rather curious to note that one of the chapters is headed "Penetration and Mixed Macadam Roads," whereas we should have probably called it "Grouting and Tar-macadam," as these questions are fully dealt with in this chapter, and much useful information is given. The book is very well printed, has some excellent diagrams and tables, and is a most useful addition to the present literature on the subject. It should be on the book-shelf of every road engineer in this country.

VALUE FOR RATE-MAKING. By H. Floy. Price 17s. nett. New York and London: The McGraw-Hill Book Company, Inc.

The purpose of the author in writing this book, which deals with the valuation of public utility properties for rating purposes according to the American practice, is to emphasise certain principles which he contends are essential in determining fair value. These principles are shortly as follows: (*a*) That the basis should be the fair present value of the property. (*b*) that this present value should be obtained by making deduction for absolute depreciation only, ignoring theoretical depreciation; and (*c*) that practically every utility property includes certain intangible non-physical elements, which should be evaluated and allowed in addition to the material sensible elements. It will be seen that the elaboration of these principles has little direct relation to English law and practice, but the volume has considerable interest for English surveyors as enabling them to draw a comparison between the methods that have grown up in this country in the attempt to apply universally the theory of the hypothetical tenant from year to year, and the less shackled system that has been evolved by American practitioners.

GEODETIC SURVEYING. By E. R. Cary. Price 10s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This book covers the whole field of geodetic surveying in a manner at once lucid and concise. Separate chapters are devoted to the subjects of reconnaissance, base lines, horizontal angles, adjustment of horizontal angles, computation of latitudes, longitudes and azimuths, map projections, trigonometric levelling, and precise levelling. The subjects of geodetic astronomy and the method of least squares, which are often treated separately from surveying courses, are dealt with in appendices. The work is one which may confidently be recommended to students.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

NEW OMNIBUS ROUTES.

THE PROPOSED CHARGES PER MILE-RUN.

The Highways Committee of the Surrey County Council reported to that body on Tuesday that they had considered the question of the opening up of new omnibus routes in the county, and had come to the conclusion that the proprietors should pay a penny per mile-run by each omnibus, satisfactory security to be given by the proprietors.

The Works Committee of the Durham County Council recommended that so far as the county roads were concerned, in cases where proprietors of motor omnibuses were anxious to ply for hire on new routes, the consent of the county council should only be given on condition that a charge of from 1d. to 1½d. per car-mile run be made, according to the size of the omnibus. It was further recommended that a conference of the various road authorities throughout the county be called, with a view to all charges being made upon the same basis. The report was adopted.

Vicissitudes of a Town Hall.—Findochty Town Council have unanimously agreed to accept the offer as a free gift of the public hall from the committee at present managing it. The building is nearly a century old. At one time it served as a lighthouse, at another as a public school, and it was originally built as a forester's lodge.

Tees Valley Water Extension Scheme.—At the last meeting of the Tees Valley Water Board it was decided to make application for a licence to complete the laying of a large conduit from the Lartington filter beds to Whorley reservoir. A sum of £28,000 had already been expended on the work when it was suspended owing to the war, and it is estimated that it will cost £20,000 more to complete it.

BRADFORD CLEANSING AND DESTRUCTORS DEPARTMENT.

SUPERINTENDENT'S REPORT.

The weight of refuse per head of population dealt with by the Bradford cleansing and destructors department is stated in the annual report of Mr. Ernest Call, the superintendent, to be 5 cwt. per annum. The number of wet ashpits in the town is about 10,000, and that of dry ashpits about 26,500, and there are, in addition, about 6,000 dustbins, &c.

Mr. Call mentions that the average number of times each ashpit, dustbin, &c., was emptied during the year ended March last was 17·54.

The present rate of pay for hired team labour is 11s. 2d. per horse per day, and 7s. 2d. for Saturdays.

In April of last year it was decided that during the continuance of the military regulations regarding restricted lighting after dusk the work of refuse removal should be continued during daylight hours. Arrangements were made accordingly, and greatly facilitated the working of the department. At the commencement, until the public got used to the changed conditions, certain details in the working of the department were commented upon, but since the arrangements got into smooth working order nothing has been heard.

TRADE REFUSE CHARGES.

The charges for collection and disposal of trade refuse have been increased from 2s. 6d. to 4s. per cart load, and from 5s. to 8s. per van load. Agreements for periodical collections are in the same proportion.

During the year the number of ashpits cleansed was 745,508, the refuse collected amounting to 72,084 loads, the average weight per load being 19½ cwt. The material was disposed of as follows: 609 loads were put on rail, 670 loads were given to farmers, 44,929 loads were tipped, and 25,876 loads were dealt with in the destructors.

WORKING COSTS.

The cost per ashpit cleansed was 5·50d.; the nett cost per load removed was 56·92d., and the cost per ton, 58·38d.

The average number of journeys per horse per night was 4·68. The average earnings of throwers-out was £1 19s. 3d.

In a comparative statement dealing with the work of the destructors department, Mr. Call states that the nett cost per load of refuse destroyed was, exclusive of capital charges, 76·79d., the figure per ton being 81·83d. The labour cost per load was 12·15d., and per ton 12·86d. Including capital charges, the nett cost per load was 117·28d., and per ton 124·19d.

The nett cost per load of the removal and disposal of refuse, including capital charges, was 97·94d., and per ton 100·45d.

FISH MANURE SECTION.

For the first time the manufacture of fish guano was treated as a separate sub-department. Unfortunately, the war has seriously affected its working. Fish has been very scarce, and the quantity of fish refuse was considerably reduced. Further than this, the price of guano dropped to £6 per ton. Compared with the previous year, the quantity of fish refuse received was reduced by 491 tons.

The cost of collection of fish refuse, and the working of the plant, capital charges, &c., were, of course, just as much as if a full quantity of fish refuse had been available. Notwithstanding these drawbacks, the sub-department shows a profit. The selling price varied from £6 to £9 10s. per ton, and the market is in a much better condition now than it was at the corresponding time last year. When things resume their normal course, a very handsome profit is expected to be shown.

Kent County Council Road Rollers for France.—It was reported at the meeting of the Kent County Council recently that two of the council's steam rollers had been requisitioned by the War Office, who would pay the cost of two new ones of the same power and weight.

Concrete Institute.—At a meeting of the Concrete Institute to be held on Thursday, December 21st, at Denison House, Westminster, Prof. Henry Adams, M.INST.C.E., will read a paper entitled "Pile Driving and the Supporting Power of Piles." The chair will be taken at 5.30 p.m.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάντ' ὁρᾷ

(One man does not see everything.)

—Euripides.

THE ORIGIN OF "SCAVENGER."

To the Editor of The Surveyor.

Sir,—Your contributor to this column, in the issue of April 28th last, asks: "What is the origin of the word 'scavenger'? Is it derived from an old Saxon word 'sceanian'—to look at, to show—as given in some dictionaries? How did this word eventually drift into an old law term equivalent to 'showage,' or a tax on goods shown? When was it that the tax-collector, to whom the goods were shown, was called a scavenger, and when did he commence in his leisure hours to sweep and cleanse the market or street where the goods were shown, and thus became a scavenger as we know him to-day? Is not the search for the derivation of words frequently a merry pastime?"

I am sorry that the extra work thrown upon under-staffed municipal officials has prevented my replying to these queries earlier. To myself, brought up under old manorial customs, the origin of words has a deep interest, and each week I have looked at your issue hoping some of your readers would afford the information asked for, but without success.

There are a good many so-called "modern dictionaries," and I could name one or two which would lead your contributor to think that the words "scavage" and "scavenger" were of the same origin.

"Scavage," "tchevage," "shewage," "scheauwing" are from the Saxon, and mean a kind of toll or custom exacted by mayors, sheriffs, &c., of merchant strangers for wares shown or offered for sale within their precincts, which is prohibited by Statute 19, Henry VII., cap. 8. In a Charter by Henry II. to Canterbury it is written "scewinga."

Scavenger is, however, from the Belgic word "scavan," meaning to scrape. Two of every parish within London and the suburbs are yearly chosen into this office, who hire men, called rakers, and carts to cleanse the streets and carry away the dirt and filth thereof, mentioned 14 Car. II., Cap. 2.

The collector of the "scavage," or "showage," was known as the "schavaldus," and might be annoyed that he should, even in mistake, have been thought to have any relation with the scavenger, either of that period or of the present time.—Yours, &c.,

Edward Walker, M.INST.MUN.E., &c.

Stretford,
Manchester.
November 13, 1916.

THE FUTURE OF GRANITE MACADAM AND CONCRETE ROADS.

To the Editor of The Surveyor.

Sir,—With reference to Mr. Boulnois' article on the above subject in your last week's issue, it may be interesting to your readers to learn that one section of the large scheme of reinforced concrete roadway on the Exmouth Marine-drive has now been completed, and the system of laying the carriageway varies very little from that advocated by Mr. Boulnois. The underbed is of sand, and the total thickness of concrete is 5 in., laid in two layers of 2½ in. each, between which is placed expanded metal.

The work was carried out in alternate bays of 25 ft. wide, and the top surface finished with a planed wood screed, which was sufficiently long to finish the whole width in one operation. Between each bay is placed a thin felt strip to provide for expansion, and the expansion joint alongside the kerbs was arranged by placing a feather-edge board between the concrete and the kerb, and withdrawing it next morning, afterwards filling with tar and sand.

The aggregate was 6 of Exmouth beach gravel to 1 of B.S. Portland cement, and I am of opinion that a fine aggregate is an essential in work of this description, in order to form a heavy, tightly bound concrete.

The surface was tar-sprayed some three weeks afterwards and traffic then allowed, which consisted largely of heavy loads of contractors' material.

A trial portion constructed in May, 1915, and over which the whole contractors' traffic of the No. 2 Section Exmouth Marine-drive was carried on a 8-ft. width, is still in perfect condition.

The roadway has a cross-fall of 1 in 40, all in one

direction, and where this can be arranged there are decided advantages viz., it absolutely ensures the proper distribution of traffic over the whole surface, and also is economical in respect of drains and gullies, as these can be arranged so that no pipes cross the road.

The subject of concrete roads is of considerable interest, and I shall be happy to supply any reader with particulars of the large work done at Exmouth, and also take this opportunity of thanking Mr. Boulnois for his excellent notes on this question.—Yours, &c.,

Samuel Hutton.
Engineer and Surveyor.

Exmouth.
November 20, 1916.

UTILISATION OF VACANT LAND IN TOWNS.

To the Editor of The Surveyor.

Sir,—The scarcity of potatoes, and the high prices asked for all kinds of vegetables, should be an inspiration to surveyors of local authorities in every town throughout the country to put into cultivation all available land suitable to the purpose of growing foodstuffs. The produce will not only be needed during the period of the war, but for some years afterwards. The town clerk and myself have pushed this matter very hard at Bognor, and in consequence nearly all the land is now in cultivation by the allotment holders. We induced the owners of building estates to hand their land over to the town authority, and we let it out in 10-rod plots, at 6d. per rod. The owners in nearly every case allowed their land to be used during "the crisis" rent free to the urban council, and I am sure landowners in other towns would be patriotic enough to do the same. Surveyors should act at once, as now is the time to break up the land roughly, and the winter frosts will do the rest, so that when the spring comes round everything will be in readiness for planting.—Yours, &c.,

Oswald A. Bridges.
Town Surveyor.

Council Offices.
Bognor, Sussex.

WHEN IS A WASTE PIPE NOT A WASTE PIPE?

To the Editor of The Surveyor.

Sir,—In erecting certain new buildings under the by-laws of the council (Model series), a builder has fixed in the bath-room a lavatory basin supplied with hot and cold water, and attached to the outlet a lead waste pipe (without trap) discharging into the bath. The bath (not supplied with taps) waste pipe is trapped and taken through the external wall, discharging into the open-air in conformity with the by-laws.

I would like the opinion of your readers as to:—

(*a*) Whether the pipe from the lavatory basins constitutes a waste pipe, requiring to be trapped and taken through the external wall in a similar manner to the bath waste? (The builder considers that the pipe from the lavatory basin is a supply pipe to the bath, and not a waste pipe.)

(*b*) What would be the position of the builder if he fixes the lavatory basin over the bath and does not affix any pipe to the outlet?—Yours, &c.,

C. R. W. C.

November 18, 1916.

TAR SURFACING AT CHISWICK.

To the Editor of The Surveyor.

Sir,—I note from the tabulated statement published in this week's Surveyor that the average cost of tar surfacing in Chiswick during the past season works out to 1·40d. per square yard. On the face of it, this is a low figure, but closer examination shows that no charges have been included for supervision, establishment, and use of machines. If reasonable amounts were added for these services the average cost would, I opine, look rather different.—Yours, &c.,

Walter Ridler, Assoc.M.Inst.C.E.,
Borough Surveyor, Tewkesbury.

November 20, 1916.

Hull Electricity Undertaking.—Owing to the output of the Hull electricity undertaking having increased by over 30 per cent. the Electricity Committee have decided to apply to the Local Government Board for sanction to purchase the water-cooling plant for which authority was asked in February, 1915.

MUNICIPAL SCHEMES AFTER THE WAR.

Blyth and Cuckney R.D.C.—The surveyor, Mr. F. Hopkinson, reported that he had prepared an estimate of the public work likely to be required in the council's district at the close of the war. This included a village for the new Firbeck Main Colliery, near Carlton-in-Lindrick, which would probably consist of a church, schools, and about 1,000 houses, and would occupy 500 men for five years. Then there would be Harworth, upon which work had ceased for the present. Here there would have to be erected approximately 900 houses. It would be to the advantage of the council to see to the provision of sewage schemes for these developments at once, and also to the provision of roads.

Kesteven C.C.—The Local Government Board have been informed that the works likely to be undertaken by the council at the conclusion of the war were new county offices, two new elementary schools, and resurfacing main roads.

Leeds T.C.—The General Purposes Committee report that the immediate requirements of the city directly the war is over will necessitate the spending of £418,000 in connection with the electricity undertaking, £178,000 for sewage disposal, £154,000 on education (for a central technical school), £85,000 each on sewerage, new streets, and the gas undertaking, and £50,000 for tramway renewals.

Walthamstow U.D.C.—Appended is a list of works which has been submitted to the Special Committee: Widening and improvement of Billet-road, Chingford-road, Fulbourne-road, Blackhorse-lane, Higham Hill-road, Church-hill, Hale End-road, Wood-street, Forest-road, Orford-road, Edinburgh-road, High-street, Grove-road, Hoe-street, and Wadham-road; laying out of land on both sides of the river Ching; new depot and workshops; construction of arterial road; railway bridge at Wadham-road crossing; completion of asphalt macadam work; laying of asphalt macadam or other paving in Woodford New-road; housing scheme; erection of a new fire station in the northern part of the district; provision of additional slipper baths in the St. James'-street and Higham Hill districts; completion of the laying out of Aveling Park, completion of sunk garden, Longfield-avenue; laying out of new recreation ground at Higham Hill at the rear of Bull's Farm; extension of bowling greens at Selborne-road and Higham Hill; building of wall round cemetery; laying out of new cemetery; the construction of the new main sewer or, alternatively, the construction of extensive filter-beds at the farm, or other works relating to sewage disposal; increased cell accommodation at the refuse destructor or other means for the disposal of the refuse of the district; reconstruction of tramways overhead equipment; fencing in land adjoining the car depot; extension of isolation hospital; construction of low-level sewer in the northern part of the district; construction of public conveniences at Wood-street, High-street, and "Bell" corner; improvement of street drainage (gullies).

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Alnwick R.D.C.—£1,725 for works in connection with the Alnmouth water supply.

Mansfield T.C.—£2,000 for the purchase of gas stoves.

Okehampton R.D.C.—£300 for the purchase of a site for a housing scheme.

Swanage U.D.C.—£350 for the repair of the sea wall.

LOANS SANCTIONED.

Selby U.D.C.—£5,400 for the erection of artisans' dwellings.

Sheerness U.D.C.—£6,680 for a water supply at Sheerness East.

A Case of Indispensability.—A well-known Chicago consulting engineer writes: "Some time ago I ordered you to discontinue my subscription, but I have concluded that I must continue the paper. Will you therefore kindly continue my subscription and send me invoice?"

SCIENTIFIC AND INDUSTRIAL RESEARCH.

By F. E. Wentworth-Sheilds, M.Inst C.E.,
President of the Concrete Institute.*

I do not want to be numbered among the croakers who decry everything that is British, and who say that our education, our science, and our organisation are neglected, and that we are a decadent nation. The war itself has given the lie to such a statement. But the war has also taught us that the courageous individualism and the keen competitive spirit which has done much to develop our national strength, has its limitations, and that in future it will be necessary to organise our manufactures and trades on more scientific and co-operative lines than ever we have done in the past.

For many years we have been dimly conscious that most of our industries could be more economically worked if we gave more attention to scientific and industrial research; but it seemed to need the European war to make us take vigorous action in the matter. It must be owned that previously our achievements in this direction compared unfavourably with those of some other nations. The National Physical Laboratory was established in 1900; but with a grant of only £4,000 per annum, its usefulness was necessarily limited. It is true that our Government has contributed to the funds of the Engineering Standards Committee and of the Imperial College of Science, both of which have done a certain amount of research work. But when we consider that the American Government has been in the habit of subsidising their Bureau of Standards to the extent of nearly £100,000 per annum, our own national expenditure on such work seems to have been poor.

But in July, 1915, a special committee of the Privy Council was formed with a strong Advisory Council, with Sir William McCormick, LL.D., as chairman, and empowered to spend £25,000 in 1915-16 on scientific research.

TESTS OF CONCRETES.

This body has already done good work. It has helped researches which had been already undertaken by various scientific societies and private firms, and has encouraged new ones. One research of great interest to ourselves is the matter of deterioration of timber, metal, and concrete in sea water, which is being investigated by the Institution of Civil Engineers. The Concrete Institute, too, has not been idle, and with the help and co-operation of the professors of several British Universities and technical colleges it has drawn up a most useful programme of tests to ascertain the best way of using various concrete aggregates obtainable in large quantities in all parts of the country. Briefly, the scheme is as follows: Concretes will be made from a variety of aggregates mixed in the familiar proportions of 1: 1½: 3 and 1: 2: 4. Others will be made equally rich in cement, but with the proportions of sand to stones varied. These concretes will be tested for strength, permeability, and other properties. In this way it is hoped to discover, not only the relative value of various aggregates, but also the most advantageous way of using them. It is evident that such a research will be of untold value to the designer, to the builder, and to the community at large.

One of the most important recent investigations on Portland cement has been made by Mr. Nathan C. Johnson, of New York. By means of the microscopic examination of various concretes he has ascertained that, generally speaking, the chemical combination between water and cement in mortar or concrete is exceedingly imperfect, and that only about 25 per cent of the clinker is properly hydrated. He suggests that an enormous economy could be effected if this could be improved, as probably the 75 per cent of uncombined cement is useless, except as a pore filler, which for this purpose might with advantage be replaced by a stronger and cheaper material. He further shows that, although this want of proper hydration is probably aggravated by insufficiency of water and of mixing, it is difficult in our present state of knowledge to avoid it. He throws out, however, some suggestions for possible improvements in this respect, and gives results of his own investigations. He points out that one impediment to proper hydration, as revealed by the microscope, is the tendency of the cement particles when mixed with water to cohere into groups, and thus avoid proper contact with the water, owing to the surface tension of the liquid itself. By the addition of certain other liquids, such as alcohol or ether, to the water, the surface tension is reduced, and the cement particles are better dispersed in consequence. The practical advantage of such added liquids is shown in testing the crushing strength of concretes made with and without the addition of such liquids. For instance, with 5 per cent amyl alcohol added to the mixing water the strength of the concrete was increased about 70 per cent at two months. It is not yet possible to point to any such substance which can be added to concrete economically, and without fear of detrimental effect, but it is clear that the subject is of the first importance, and calls for further research.

DISINTEGRATION OF CONCRETE.

This is the more evident when we consider that the uncombined cement in a concrete is not only wasteful, but may even under certain circumstances be dangerous. This is clearly shown in a paper read by Mr. A. H. White before the American Society for Testing Materials. He describes investigations and experiments that seem to show that concrete, if alternately wetted and dried, is made to expand and contract, the nett result being a gradually increasing expansion, and that if the process is repeated often enough disintegration may result. This disintegration is explained by him as follows: When water enters into the pores of dried concrete, it combines with cement clinker which has as yet been unaffected. The result is that the concrete is expanded and the pores filled up, whereupon the action ceases until the concrete is dried again. Then the concrete once more becomes porous, and on re-wetting the expanding action is repeated. It is rarely, of course, that deterioration from this cause becomes serious in practice, but instances of such deterioration are not unknown, especially in the case of marine works and of pavements exposed to weather. They can probably be guarded against by the use of some protective coating; but this, again, is a matter which requires investigation.

The researches to which I have here alluded may all be classed as industrial, in that they may be expected to introduce economies in some industry (the building industry in these cases) within a measurable period. It is important that researches which are more purely scientific and less utilitarian should not be neglected. . . . Such purely scientific researches cannot, perhaps, be undertaken by societies like our own. But they ought to be carried on in every important laboratory, and encouraged by grant of public funds.

On the other hand, industrial researches—those, namely, which may be expected to produce quick and practical results—should be undertaken under the guidance of men who not only have scientific knowledge, but who are also acquainted with the actual working of the industry for whose benefit the research is needed. To carry this out effectively means co-operation between the laboratory and the works, or, say, between the professor and the manufacturer. It means even more than this—namely, co-operation between the various manufacturers who have hitherto been inclined to look upon each other as rivals, and to conceal from each other any knowledge and experience they may have gained.

* From inaugural address delivered last night.

Council and Surveyor.—The surveyor to the Belturbet, co. Cavan, Urban District Council, in a report recently to that authority,, stated that he had repeatedly pointed out that the summer season, when the council's men were not busily engaged, was the time to provide a stock of metalling, but his advice had been disregarded, with the result that now, with short days, inclement weather, roads falling out of contract and double the number of the usual works under direct labour, the work would have to be carried out at double the expense to the ratepayers. He also referred to the council not having availed itself of the railway companies' offer of £100 towards the work on the road to the station. The chairman said that Mr. Brady's reports were really attacks upon the council. They should deal with the streets and roads and nothing else. Mr. Brady said the council should be guided by those who were capable of directing them. The chairman: In future those reports must be previously submitted to the chairman and clerk. Mr. Brady: For censorship, I suppose? The chairman: It is the wish of the council, not mine. I ask the Press not to publish them. Mr. Brady: I will send the reports to the Local Government Board.

ST. ANDREWS WATERWORKS ARBITRATION.

The result of the arbitration between Mr. James Kinniburgh, public works contractor, Glasgow (claimant), and the town council of St. Andrews is announced by the *Dundee Courier*. Mr. Kinniburgh entered into a contract with the town council in December, 1909, to do the work connected with the new waterworks in two years. Owing to unforeseen circumstances, which Mr. Kinniburgh held were the entire fault of the town council, nearly four years elapsed before the work was completed.

Mr. Kinniburgh's claim on account at the finish of the contract amounted to £24,699 7s., and the payments made at the date of arbitration were £13,708 13s. The contractor's total claim was £10,990, and the engineer proposed to allow him £1,762 10s. 4d. Previous to the arbitration the town council offered a further sum of £200 in full settlement. Mr. Kinniburgh refused that sum, but suggested a conference between his agent and the Water Committee of the council. It was not entertained.

The council's claim against Mr. Kinniburgh was for £1,990 1s. 2d., chiefly for delay in completing the works. They deducted from that sum the £1,762 10s. 4d. admitted by the engineer to be due, which brought out a balance in their favour of £227 10s. 10d., which sum they counter-claimed. The arbitration proceedings were held in St. Enoch's Station Hotel, Glasgow, and extended over a period of thirteen days. The arbiter was Mr. James Watson, M.INST.C.E., Bradford, who, by the way, was the town council's consulting engineer.

The arbiter finds Mr. Kinniburgh entitled to the sum of £3,602 18s. 5d. in settlement of his claim, with interest on £1,762 10s. 4d. at 4 per cent. from November 28, 1914, to November 28, 1915, and thereafter till payment at 5 per cent, and interest on the balance of £1,840 8s. 4d. from October 6th till payment is made at 5 per cent. He repels the respondents' counter-claim, and finds them liable in the payment of the fees and outlays of arbiter and clerk of the reference, the shorthand writer's account to be paid one half each. Mr. Kinniburgh gets £200 modified expenses.

The cost of the arbitration to the town council is computed at about £6,000, and it is stated that Mr. Kinniburgh privately offered through a member of the council to settle for £5,000. Moreover, it is said that he would have accepted considerably less than that sum in order to avoid arbitration.

"REMUNERATION" FOR EXTRA SERVICES.

A TRING URBAN COUNCIL DISCUSSION.

At the last meeting of the Tring Urban District Council (the *Bucks Herald* reports), the question of the surveyor's remuneration for extra services in the absence of the road foreman, who is on active service, came up for discussion.

The surveyor said the council granted him the extra allowance up to the end of October, but he had done the extra work up to the present time. The work must be done by someone, and the only alternative to the present arrangement was to appoint a road foreman. If that was the view of the council, he should be pleased to advertise, though he was afraid there was not much chance of getting a suitable man. He anticipated losing one of his best men, as he was likely to be called up shortly.

Mr. Hedges said he could not support a continuance of the present arrangement, as the men worked fewer hours in the winter than in the summer. In his opinion they could do without a foreman with their present competent staff—some of the best workmen in the town. Ten shillings a week extra during the short days was rather

A HEAVY LEVY ON THE RATEPAYERS

He moved that the extra remuneration to the surveyor be reduced during the short days to 5s. a week.

Mr. Batchelor seconded, and said he did so in the public interest. When the council appealed for the surveyor they were told there was extra work to be done. Had that appeal not been successful the surveyor would probably be now serving in his Majesty's Forces at 1s. a day. They all had to do extra work at the present time, but they were prepared from patriotic motives to put up with some inconvenience.

Mr. Griffin thought it was a question whether they should pay the surveyor 10s. a week for his extra work or engage a road foreman at 30s. or £2 a week.

Mr. Hedges believed they were in a position with their present staff to do without a road foreman, especially as no works were now being carried out.

Mr. Smith said they ought to take into consideration the shorter hours now being worked. As a council they would not be justified in spending the ratepayers' money without good reason.

Mr. Bly supported the resolution. As a business man he found he had to do a great many things he did not have to do before the war.

The surveyor, in reply to the remarks about patriotism, said he would like to say that he considered himself as patriotic as any other man. He did not ask the council to appeal for him, and the day might yet come when he should find himself in line with his fellow-townsmen who had joined up. He wished to make it plain that he had not hidden behind the council, or asked them to appeal for him. The hours the men worked did not affect him at all. He was entirely in the council's hands. He was their officer, but his office did not include the duties of road foreman. He was their surveyor and inspector, but not their road foreman; and it was open to him to undertake the duties of foreman or not. He was entirely in their hands, and whatever they were prepared to pay him for this extra work he should accept. To him it was a question of principle rather than money.

The resolution was then put and carried.

FORMER WHITEHAVEN SURVEYOR'S FORTUNE.

BEQUEST TO THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

Among the beneficiaries under the will of the late Mr. Richard Pickering, at one time surveyor to the urban sanitary authority—now the corporation—of Whitehaven, is the Institution of Municipal and County Engineers. Mr. Pickering, who died on October 4th last, left estate valued at £27,328 gross, with nett personalty £25,403, and his legacy to the institution, of which he was one of the oldest members, is one of £500.

Mr. Pickering started life in humble circumstances. As a boy he went to work in the summer months and attended school in the winter. He served his time as a mason, and was afterwards employed on public railway works, including the chief railway station at Newcastle-on-Tyne. He then came South, where he remained for two years. Having married, he returned North, and was engaged on small contracts, the last being a bridge for the Cumberland County Council. Mr. Thomas Milton was at the time county surveyor of Cumberland, his assistant being a Mr. Watson. As Mr. Watson contemplated leaving, he commended Mr. Pickering to Mr. Milton, and Mr. Pickering was appointed assistant county surveyor. This appointment he held for fifteen years, finishing under Mr. Cory, who succeeded Mr. Milton. He then became one of four selected candidates for the county surveyorship of Northumberland, but Mr. Howieson, county surveyor of Durham, secured the position. He was subsequently a candidate for the county surveyorship of Durham, Montgomeryshire, and a division of Devonshire. Eventually he accepted an appointment at Whitehaven, under the Turnpike Trust, and at the same time began private practice in conjunction with a Mr. Crompton, whose previous experience was mainly in connection with railway work. For some time he devoted his attention chiefly to waterworks and drainage, and was involved in many Parliamentary fights. In 1885 there was a circular issued by the corporation of Victoria, British Columbia, inviting the best-known sanitary engineers in Great Britain, the United States and Canada, to send in designs for the sewerage of Victoria. Mr. Pickering's designs were accepted by the corporation, and in the following year Mr. Pickering started for British Columbia, and was wrecked in the "Oregon," barely escaping with his life, but losing most of his plans. He remained in Victoria three months and set the scheme in operation. In 1889 he went there again to advise in respect of waterworks. Subsequently he journeyed to California, with introductions from the late Sir Robert Rawlinson, and studied waterworks there and elsewhere.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Dundee T.C.—The town council have accepted the offer of Mr. F. B. Sharp, jute manufacturer, to provide an infant clinic for the town after the war, at a cost of £4,000.

Fulham B.C.—The provision of a public convenience between Walham Green and Putney Bridge has been referred to the Public Health Committee.

Gosport and Alverstoke U.D.C.—A committee has been appointed to submit proposals to the superintending engineer of the dockyard for the construction of a new landing place at The Hard, and other works.

Kirkintilloch T.C.—The Baths Committee have been authorised to build slipper baths on a site adjoining the town hall in Union-street.

Newton Abbot U.D.C.—It has been agreed to purchase the freehold of the stone depot in Salisbury-road for £180.

Saltcoats T.C.—It is proposed to build a house for the staff at the joint hospital, at a cost of about £400.

HOUSING AND TOWN PLANNING.

Edinburgh T.C.—The question of the provision of working-class houses is being considered by a special committee, the municipal estate at Gorgie being mentioned as a suitable site.

Glasgow T.C.—The housing question and a city improvement scheme will be considered at a meeting of the town council in committee to be held in the near future.

Shrewsbury T.C.—The borough surveyor, Mr. A. W. Ward, has received instructions to proceed with the completion of the plans of the housing scheme preparatory to another application being made to the Local Government Board for a loan of £22,030. It is proposed to proceed with the scheme on the conclusion of the war.

MOTOR TRANSPORT.

Barrow-in-Furness T.C.—Inquiries are being made as to the price of a new motor fire engine.

Cuckfield R.D.C.—The council have agreed to the purchase of a motor ambulance.

Devon C.C.—An additional steam tractor is to be purchased for £556.

Dumbarton T.C.—It is proposed by the public works of the town to provide a motor ambulance at an estimated cost of £600, and the town council have referred to a committee a suggestion that the municipal workmen should be asked to contribute £50 towards the vehicle.

Islington B.C.—It has been decided to purchase a motor sweeping machine at a cost of £650.

Marylebone B.C.—The Works Committee reported, with regard to a third Laffly motor road sweeper, the purchase of which was authorised by the council on December 2, 1915, that, although the British agents of the French manufacturers entered into a contract to supply the machine, they had been unable to deliver it owing to the action of the French Government in commandeering all the machines at the works and forbidding the manufacture or export of any more. A similar situation had arisen with regard to the supply of spare parts for the two existing machines, and the committee were trying to arrange to obtain these in England.

Southampton T.C.—The question of purchasing another motor ambulance is being considered.

Walsall T.C.—The Watch Committee recommend the purchase of a new 300-gallon steam fire engine.

Wantage U.D.C.—The question of purchasing a motor tractor for the steam fire engine is being considered.

REFUSE COLLECTION AND DISPOSAL.

Canterbury, New South Wales, T.C.—The town council are considering the provision of a refuse destructor.

Kiveton Park R.D.C.—The surveyor, Mr. F. Hewitt, has prepared a report on the refuse destructor and sewage disposal works at Dinnington, in which he has submitted estimates for reconstructing the cells and providing a new boiler, clinker crushing and screening plant, and a tin-baling press. The matter is being dealt with by a committee.

ROADS AND MATERIALS.

Banchory T.C.—The burgh surveyor has been instructed to proceed with the fitting of luminous boards at street corners, the trial posts having proved suitable.

Bedwas and Machen U.D.C.—A Bill is being promoted by the council for power to run omnibuses over the roads in their area.

Bethnal Green B.C.—The borough council announce that they will be prepared to supply inhabitants of the borough with powder for whitening street projections and kerbs free of cost.

Bexhill T.C.—It had been suggested by the Commercial Association that, in view of the number of street accidents which had occurred, the council should consider the desirability of placing small red or green lamps at dangerous spots, and on permanent obstructions such as lamp-posts in the middle of the road. The Highways Committee were of opinion that a more practicable method of dealing with the difficulty referred to, and a method to which there could be no objection under regulations now operating, was to whiten all lamp standards placed in the carriageway and in the more prominent positions on the footway. The borough surveyor, Mr. G. Ball, had been instructed accordingly, and the council confirmed the committee's action.

Bradford T.C.—The system of public lamp shading adopted by the corporation receives appreciative notice from the *Manchester Guardian*. The lamps have blackened tops and a black band some 2 in. or 3 in. deep on the sides. The rest of the sides is shaded with whity-brown paint of the density of tissue-paper, which permits of a wide diffusion of light that has lost its intensity. Another good thing in Bradford is the whitening of the salient angles of buildings and the street corners. This has been done systematically and well by using whitewash, and the labour of three or four men is sufficient to keep the marks fresh.

Caerphilly U.D.C.—The council are promoting a Bill in Parliament for authority to provide and run omnibuses over the roads in their district.

Chorley R.D.C.—The surveyor has been asked to prepare an estimate of the cost of a proposed new road from Heskin to Welch Whittle.

Diss U.D.C.—The council have agreed to offer a horse sweeper and two tipping carts to the Government for use on the roads in France.

Dudley T.C.—The Housing Sub-Committee recommend the construction of a road from the hutments site to the housing site, at an estimated cost of £531.

Hazel Grove U.D.C.—It has been decided to execute paving works in Torkington-road, at an estimated cost of £150.

Kesteven C.C.—The county surveyor, Mr. W. B. Purser, reported that the carting contractors had refused to continue their contracts for another year, and he had invited tenders for 1917-18, which, generally speaking, showed a rise of 2s. per ton. The Road Board had agreed to contribute £2,054, and the county council £513, for the reinstatement of London-Thorpe road, and in addition the Road Board had agreed to supply some labour towards the scavenging. The report was adopted, and the county surveyor's agreement with the Road Board was confirmed.

Louth R.D.C.—The Highway Committee, having considered the position as to roads, owing to two surveyors (Messrs. Lowis and Ingle) having joined the Colours, recommended that the remaining surveyor (Mr. C. Robinson) be asked to undertake some of the duties for their districts. This the council have agreed to.

Mansfield T.C.—The borough surveyor, Mr. T. P. Collinge, has been instructed as an experiment to paint the lamp standards in one street white and in another street coat them with luminous paint. The tramway company has been requested to paint a white band

round their standards.—An intimation has been received from the Road Board of their intention to bear half the cost of resurfacing Sherwood road with tar-macadam.

Mayo C.C.—The result of the main roads inquiry was finally announced at a recent meeting, the Local Government Board deciding to continue in the county the old system of main roads, but with a reduced mileage.

Newhaven R.D.C.—An agreement has been reached with the county council for the repair of the Newhaven to Lewes road near Northease, at the expense of the county council.—The council have resolved to keep open the places of the men who join the Forces.

Norfolk C.C.—Twenty-three tenders were received by the Western Highways Committee, and ten accepted for the supply of granite for the year 1917. It was stated that there was only a difference of 5d. per ton between the highest and lowest tender. The cost had increased at from 1s. 6d. to 2s. per ton, owing to the increased cost of labour and carriage. More tenders were accepted than usual, so as to ensure a bigger supply. Mr. H. E. Upcher moved that as a Road Committee they should communicate with the War Office and the Home Office, urging that German prisoners detained in this country should be employed in the quarries. He did not see why they should remain idle. Mr. H. A. Day thought that if the Government allotted German prisoners to the quarries the committee might get its granite cheaper. He suggested that a clause should be inserted in the contracts to that effect. Mr. S. Oldman said he had no hope of getting the granite cheaper, but they might get larger supplies than they were doing at present. Sir T. L. Hare understood that the Government would not allow a lower rate of wages to be paid, but would take the difference. Mr. Upcher's resolution was carried. It was decided to purchase five snow ploughs of an improved model, at a cost of £10 each, to replace others which were beyond repair.

Orsett R.D.C.—The surveyor, Mr. F. T. Johnson, has received instructions to obtain materials, estimated to cost £250, for putting the road between Vange and Fobbing into a condition to bear the increasing traffic.

Pontardawe R.D.C.—The surveyor, Mr. J. Morgan, reports that extensive repairs will be necessary on the Mawr roads owing to the damage caused by the haulage of timber.

Rhyl U.D.C.—The sand drifts continue to cause anxiety to the council. The surveyor, Mr. Arthur A. Goodall, reported recently that 994 cartloads of sand had been removed from the promenade and parade roadways during the month ending October 19th. The planting of grass on the sand hills had been proceeded with, but he was afraid the work would have to be suspended owing to the difficulty of obtaining Marram grass. The sand storms of September had covered up large tracts of grass on which the supply depended. The matter was referred to the Road Committee with power to act.

Surrey C.C.—A contribution of £250, being one-fourth of the expenditure incurred in the widening of Kew-road, has been agreed to.

Wombwell U.D.C.—Tenders are to be obtained for a new tar-spraying machine, at an estimated cost of £100.

SEWERAGE AND SEWAGE DISPOSAL.

Atherstone R.D.C.—It was reported that the proceeds of the sale of produce on the sewage farm, consisting of 12 acres, had reached the remarkable total of £428.

Aylesbury U.D.C.—The surveyor, Mr. W. H. Taylor, has been authorised to purchase a storm filter gauge for the sewage disposal works, at a cost of about £42.

Louth R.D.C.—Instructions have been given for the execution of the Saltfleet drainage works without delay.

Melton Mowbray R.D.C.—The council have adopted a scheme for sewage disposal at Asfordby, the cost of which is estimated at £802.

WATER, GAS, AND ELECTRICITY.

Alnwick R.D.C.—The council are asking the authority of the Local Government Board to proceed with the Alnmouth water supply scheme, which has been prepared by the surveyor and sanitary inspector, Mr. M. Temple Wilson. The lowest summer yield of all springs available would be 41 gallons per minute, equal to over 34 gallons per head of the estimated population of 1,700. The cost at current prices is estimated at £1,725.

Bedwas and Machen U.D.C.—The council are promoting a Bill in Parliament for authority to prepare a water supply scheme for Upper Machen, and also to supply fittings.

Castlereagh R.D.C.—From the tenor of an interview which a committee had with the Water Commissioners it is hoped that the council will obtain the additional supply of water they require upon reasonable terms.

Greenock T.C.—The nett surplus on last year's working of the electricity undertaking was £6,998. The working expenditure is £22,025 more than last year, the great output of energy being partly responsible, but the major portion was made up of extra coal costs, which represented a sum of £7,917 on the year's output.

Llandudno U.D.C.—It was reported that there was an increasing loss on the electricity undertaking due mainly to the higher price of fuel. The Electricity Committee recommended the council to raise the flat-rate charge for current to 8d. per unit, and other rates in proportion, but the council decided not to entertain the proposition.

Morecambe T.C.—The question is under consideration of installing mechanical stoking plant at the gasworks, at an estimated cost of £3,000.

Oldham T.C.—The Electricity Committee propose to instal electric street lighting in the centre of the town at a cost of about £500.

Omagh U.D.C.—The stokers at the gasworks have received an additional allowance of 1s. 6d. per week as a war bonus, this being the third increase they have been voted. The Finance Committee reported that this department was costing the ratepayers a very heavy amount, owing to the increased cost of coal. The chairman remarked that at the present time the position of affairs at the gasworks was financially very serious, and would be worse before the end of the year. As far as the ratepayers were concerned, it would be better to close the works down altogether.

Richmond (Yorks) T.C.—The town council have agreed to a proposal to provide additional plant at the gasworks, at an estimated cost of £750.

St. Ives (Cornwall) T.C.—A committee has been authorised to consider the improvement of the water supply.

Wellingborough U.D.C.—A new filter is to be installed at Bushfield waterworks, at a cost of £512.

MISCELLANEOUS.

Atherstone R.D.C.—The council have agreed to release the assistant surveyor, Mr. Ellis, for work of national importance.

Fleetwood U.D.C.—The surveyor, Mr. E. Frobisher, has been instructed to prepare an estimate of cost for the extension of the sea wall.

Hendon U.D.C.—A further war bonus of 2s. 6d. per week, involving an additional expenditure of nearly £1,000 a year, is being given to all the outdoor employees of the council.

Kingstown U.D.C.—The Local Government Board have forwarded a scale of official salaries for the guidance of the council, which, they wrote, compared not unfavourably with those granted to officials in adjoining towns. The clerk said the board suggested with regard to the surveyor (Mr. J. Berry) that his maximum salary should be £450, while in the council's scale it was £500. The chairman said the district was a most important one, and it was only fair that a surveyor, after twenty years' service, should receive £500 a year. The council resolved to ask the Local Government Board to receive a small deputation on the subject.

West Sussex C.C.—The council last week voted £5,000 to the East Lancing Sea Defence Commissioners for the purpose of sea defence works.—The council have adopted a resolution advocating a reform of the system of coinage and weights and measures.

Worthing's Scheme for Potato Growing.—The mayor of Worthing is appealing officially to the owners of 77 acres of vacant land in the borough to place their plots at the disposal of a corporation committee with the object of growing potatoes or other vegetables in the forthcoming season.

PERSONAL.

Mr. C. H. Bressey, surveyor to the Wanstead Urban District Council, has accepted a commission in the Royal Engineers, and left for France a few days ago.

Mr. E. Hewett, assistant district superintendent in the main drainage branch of the chief engineer's department of the London County Council, is retiring after thirty-four years' service.

Mr. C. T. Fulcher, deputy borough engineer of Shoreditch, was on Tuesday voted an honorarium of £100, and an increase of salary of £100 per annum so long as he continues to discharge the duties of borough engineer.

Mr. W. A. Clegg, surveyor to the Dorking Urban District Council, was on Tuesday last appointed surveyor to the Littlehampton Urban District Council at a salary of £220, rising to £300 per annum. There were 154 applicants for the post.

Sergeant Crawford, who has been foreman pavior to the Bedford Corporation since 1912, has been awarded the Military Medal for conspicuous bravery in taking a convoy up to the firing line over a road which was being heavily shelled. One man and two horses of the convoy were killed.

Mr. Robert Owen, deputy city electrical engineer of Leeds, has been offered the vacant position of electrical engineer for the borough of Wigan, at a salary of £550 per annum, with house, lighting, and fuel, or at a salary of £600 without house, light and fuel. There were 106 candidates for the position.

Mr. R. O. Roberts, surveyor to the Pontypool Rural District Council, will be called up for military service early in December. His military pay will be made up to the equivalent of his present salary. Mr. Derrett has been asked to perform the dual duties of surveyor and inspector, at an increased salary at the rate of £40 a year until Mr. Roberts returns.

Mr. W. Watson, burgh surveyor and sanitary inspector of St. Andrews, who has been receiving an additional allowance at the rate of £100 per annum as engineer in connection with the construction of the waterworks at Cameron, will cease to draw this money upon the completion of the contract, and it has been arranged that his salary will be £260 a year, with annual increments of £10 until a maximum of £300 is reached.

Mr. Raymond Unwin, adviser in town planning to the English Local Government Board, was entertained at a civic luncheon in Dublin on Saturday. The Lord Mayor presided, and the guests included Sir William Byrne, the new Under-Secretary. Mr. Unwin, who had lectured the previous evening on "The Reconstruction of Dublin," said thousands of pounds could be saved to the citizens of Dublin in the next generation by laying down a rational plan of reconstruction now and taking it as their guide in future building schemes.

Lieutenant Philip Charles Purser, of the Royal Flying Corps, has been awarded the Military Cross for conspicuous gallantry. He twice carried out long reconnaissances and obtained valuable information, and he had previously done fine work on offensive patrols. Lieutenant Purser is the second son of Mr. W. B. Purser, Assoc.M.Inst.C.E., of Grantham, the county surveyor for Kesteven. In October, 1914, though then only eighteen, he joined the Forces, and in January this year he became attached to the Royal Flying Corps. He went to the Front in June last and received his commission in the R.F.C. in September. Lieutenant Purser is now home on leave.

Colonel Davison, water engineer to the Liverpool Corporation, who is at the Front, relates an amusing incident of trench life which appealed to him professionally as well as from its humorous aspect. He found a subaltern in charge of a trench too deep in water, and he ordered the water to be removed. On his next visit he noted the disappearance of the water, and having commended the subaltern for his promptitude, he asked how he had got rid of the water, which could not be pumped. The subaltern confessed that he had taken the only course open to him by turning the water into the neighbouring trench! Colonel Davison visited this trench, and found the subaltern there labouring under the impression that the water in his trench had risen "through the action of a spring." Returning to the former trench, the colonel instructed the ingenious subaltern there, himself an engineer, to dispose finally of the water. This was soon effected by a gang digging a shallow channel to a canal.

The appointment of Mr. H. P. Maybury, manager and engineer to the Road Board, to be Deputy-Director of Transportation and Principal Road Engineer, and to be a temporary Brigadier-General was gazetted on Tuesday night.

OBITUARY.

We regret to record the death of 2nd Lieutenant Thomas Higgins, R.E., which took place in France on Wednesday, November 15th, from wounds received about October 15th. Lieutenant Higgins, who received the Military Cross only as recently as September last, was formerly an engineering assistant to Mr. E. G. Mawbey, the borough surveyor of Leicester. He joined the Royal Naval Brigade, Engineering Section, in October, 1914. He received a commission in the Royal Engineers in April last, and left shortly after for France. Such an untimely end to a highly promising career will be deeply regretted by his colleagues and friends in Leicester, and by all with whom he has been associated professionally.

Second Lieutenant Dudley Collins Francis, only son of Mr. and Mrs. H. Francis, of Plymouth, has been killed in action, we regret to state. The deceased officer was well-known in Plymouth, where he was held in high regard by a large circle of friends and acquaintances. Born at Stoke, he was educated at Plymouth College prior to going to Owen's College, Manchester. He returned to Plymouth, and was articled to his father, who was formerly water engineer to the Devonport Water Company. At the conclusion of his term of apprenticeship he qualified as an associate member of the Institution of Civil Engineers, and shortly afterwards was offered a lucrative appointment by the Rand Water Board, Johannesburg. His merits were such that he soon became chief assistant. While he was spending a holiday at Durban war broke out, and he immediately returned to England. He was one of the first to join the Public Schools Battalion, but after twelve months decided to go to the Front as an ordinary soldier. This he did in November, 1915, and until March last fought in the trenches. He was then selected for a commission, and after a short stay at home went through his training at Christ's College, Cambridge. On July 8th he was appointed Second Lieutenant in the Yorks and Lancs Regiment, and on September 2nd he returned to the Front. He was very popular among his fellow officers and men.

INSTITUTION OF WATER ENGINEERS.

WINTER GENERAL MEETING.

The twenty first winter general meeting of the Institution of Water Engineers will be held at the apartments of the Geological Society, Burlington House, W., on Friday, December 8th, commencing at 2.45 p.m.

The following papers will be read and discussed:—

(1) "The Cross Hill Covered Service Reservoir for the Birkenhead Corporation," by W. J. E. Binnie, M.Inst.C.E., B.A.(Cantab).

(2) "The Rating of Waterworks," by Charles Clifton, P.A.S.I.

A Glossary of Road Terms. By H. Percy Boulnois, M.Inst.C.E. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 2s.—Mr. Boulnois has achieved far more than he may imagine by this production of his pen. He set out to standardise the nomenclature of road terms; in addition he has made a valuable addition to English literature. To the untutored it is like reading a new language; Mr. Boulnois says it isn't anything like "complete." At any rate, it is a valuable *vade mecum* which no one has attempted before.—*Portsmouth Times.*

A Limit to Appeals.—At Worthing Military Tribunal, on Wednesday, the borough surveyor applied on behalf of a corporation pavior, who had lost his exemption as a fireman on a military appeal to the Central Tribunal. Mr. Charles considered the claim could not be entertained. It meant the corporation could apply for the same man in different capacities, and there would be no limit to it. They would be putting this man in as a town clerk next, and seeing if they could get him off on that ground. It was decided that the claim could not be considered.

ROAD MAKERS FOR FRANCE.

AN APPEAL TO ENGINEERS AND SURVEYORS.

Mr. H. P. Maybury, M.Inst.C.E., whose appointment on the staff of Sir Eric Geddes, Inspector-General of Transport, was announced in our issue of the 3rd inst., is to have charge of the construction and maintenance of roads required for use by the British forces in France, and will take the rank of Brigadier-General.

In his circular to county and other road authorities already outlined in our columns, Mr. Maybury states that it has been decided to set up a proper road organisation, officered by municipal and county engineers and engineers of public works contractors, non-commissioned officers who would be skilled foremen of either local authorities or public works contractors, and experienced workmen.

"A large number of engineers and surveyors," Mr. Maybury proceeds, "are already serving with the Colours, and if information relating to these gentlemen could be furnished to me, an endeavour would be made to secure them for work for which, by their training and experience, they are peculiarly fitted. The same remarks apply to foremen and men, and information is requested at once, showing: (*a*) In the case of officers their rank and the unit to which they are attached; and (*b*) in the case of non-commissioned officers and men, their full names, regimental numbers, units to which they are attached or belong, and rank, if any. With this information should be forwarded a statement showing the particular duties performed by each individual in civil life.

"Further, it is desired to attract to this important service as many municipal and county engineers, engineers of public works contractors, and their workpeople, as may now be employed in this country.

"It is fully appreciated that the work upon which such officers and men are now engaged is, no doubt, of some national importance; but it will not be suggested that any such work is of so essential a national character as that now required to be performed overseas.

"Being persuaded that you will share these views, I write to ask for your kind interest and assistance in securing as many skilled engineers and surveyors as may be necessary to equip the new organisation, together with the largest possible number of foremen and workmen who are reasonably fit, and not exceeding fifty years of age. Suitable rank would be given to officers, foremen would receive non-commissioned rank (with corresponding rates of pay); while the men would be paid 3s. per day, their families receiving the usual separation allowances.

"It should be possible even now for each of the more important counties and county boroughs to raise, say, two complete works companies, equal to 500 men; while the less populated ones could, probably, raise a single company.

"All officers and men so enlisted would be posted to the Corps of Royal Engineers, and their services would be required for the duration of the war. They would not be armed.

"I shall be much obliged if you will kindly take immediate action upon this request, with a view to securing in your area the largest possible number to assist in this important national work, forwarding to this address, by an early post, a statement dealing with—(1) All men who are already with the Colours, as requested in (*a*) and (*b*) above, and (2) a full detailed statement giving names, addresses, age, occupation and all particulars of officers and men who can be secured for the new service."

Coast Sand Dunes (By Gerald O. Case, St. Bride's Press, Limited, 24 Bride-lane, E.C., price 5s.).—Mr. Case has done a valuable work in the writing of this book.—*Southport Guardian.*

Road Work for German Prisoners.—Honiton Rural District Council on Saturday last decided to ask the Government to allow them to have German prisoners to do the work on the main trunk roads in their area. Members pointed out that it would be better to employ German prisoners on the roads instead of women, who would be better employed on the land. The surveyor, Mr. W. North, said the county surveyor stated that the main trunk roads must be maintained, but district roads would have to go, as the roads in France were more important.

SOCIETY OF ARCHITECTS.

MR. EDWIN SADGROVE'S PRESIDENTIAL ADDRESS.

A number of interesting topics were touched upon by Mr. Edwin J. Sadgrove, F.R.I.B.A., in the course of his presidential address on the 16th inst. before the Society of Architects.

ANCIENT LIGHTS.

The question of an amendment to the law of ancient lights on lines suggested by the society years ago had, he pointed out, been revived outside the society. That was a healthy sign, and presumably those who were agitating in this direction would be prepared to co-operate with the society and other interested bodies. The appointment of a tribunal for the settlement of contentious points in advance ought to appeal to all concerned, and should not be beyond the powers of the profession to accomplish.

ARCHITECTS' FEES.

The present scale of architects' fees was altogether inadequate, in his opinion; and, apart from this, it appeared to him to be wrong in principle for an architect to be paid on a commission basis, for obvious reasons which he need not labour. What was wanted was not a revision of the present scale so much as an alteration in the system of charging. The question of the conditions of competition was another very large subject which demanded attention.

THE COST OF BUILDING.

Another matter which the society was already dealing with was the question of new methods of construction, the more extended use of by-products in connection therewith, and the local manufacture and utilisation of certain materials for use in building.

The deeper one went into this matter, which was one intimately connected with reducing the cost of building, the more one was impressed with the necessity for some relaxation of local building by-laws and for more elasticity in their scope and application. These regulations must be adapted to modern requirements and made so elastic as to cover and provide for new developments, and so obviate the necessity of making amendments to the regulations from time to time to meet special circumstances. Local authorities should be given greater discretionary powers within their areas, and he felt sure that with a little organisation and co-operation between professional bodies it would be possible to impress upon the Local Government Board the desirability of making changes in the direction indicated.

OUT OF THE LIMELIGHT.

There was just another matter which might fall within the scope of the society to take up, and that was the proper acknowledgment of the architect in any publicity relating to a building for the design and erection of which he was responsible.

One frequently saw the announcement in the Press of the formal opening of a building where everyone concerned was in the limelight except the architect.

Possibly architects were themselves to blame for this sort of thing in not insisting on proper recognition; but why should they be more diffident than any other artists? The architect could only be known by his works if his name was associated with them, and it might be well for all concerned if that association could be of a permanent character for all to see, so that by his works he could be judged as well as known.

Motor Sweeping at Islington.—The Works Committee of Islington Borough Council had had under consideration the question of substituting motor sweeping machines for cleansing the roads in place of horse-drawn machines. From the report of the borough engineer, Mr. J. Patten Barber, the committee gathered that the work accomplished in normal times by twenty-one horse-drawn machines could be done by three motor sweeping machines, and that a saving estimated at £525 per annum would be effected. For the period of the war the road cleansing work had been very considerably curtailed, and it was calculated that one motor sweeper would be sufficient for the time being. It was agreed to purchase one motor sweeping machine at an estimated cost of £650.

THE ROAD BOARD FUNDS.

THEIR APPLICATION AFTER THE WAR.

In the House of Commons the Secretary to the Treasury was asked to state the total amount of funds now standing to the credit of the Road Board: what present use is being made of them; and whether any definite policy is under consideration for dealing with these funds after the war.

Mr. McKinnon Wood said the total amount of funds (including investments at cost) standing to the credit of the board on October 31st was £3,763,569. New advances from the fund had been restricted to a limited sum (£200,000 in 1916-17) which was applied to the surface preservation of important roads. The available funds in the hands of the board were invested, largely in short-term Government securities. After the war the funds of the board (of which a considerable sum had already been promised to local authorities) would be applied in the manner provided by the Development and Road Improvement Fund Act, 1909, in the absence of amending legislation; but the rate of expenditure would no doubt depend on the state of employment and on other conditions which could not at present be foreseen.

WEIGHTS AND MEASURES.

A DEFENCE OF THE BRITISH SYSTEM.

In an address last week to members of the Birmingham Chamber of Commerce, Mr. George Moores, secretary of the British Weights and Measures Association, gave the results of a recent visit to America, made for the purpose of finding out why they did not adopt the metric system there, and quoted the statements made by several important firms. One big firm of engineers said the probable effect upon them of the introduction of that system would be the provision of a new stock of standard tools, dies, and gauges, together with new stores, the conversion of existing drawings into metric terms, the establishment of new standards for the estimating and cost departments, and greater liability to clerical errors, both in the drawing office and the shops. As to the question of cost, the Franklin Institute—an institute of higher engineering—had gone into the matter thoroughly, and the committee appointed for this purpose found that in a well-regulated machine shop, employing, say, 250 workmen, the cost of adopting the metric system would be anything from £30 to £120 per man employed. And, finally, when all this money was spent, nothing better than the old system would be obtained. Dealing with foreign trade, Mr. Moores said the fact that in the past British Consuls to a large extent had been anything but British accounted to a considerable extent for the recommendations made for a change in our system of weights and measures. Though, as he admitted, that system contained many anomalies, they could say it had been a very useful one, and on it Englishmen had built up the greatest export trade any country had seen.

Ballymena's New Waterworks.—The new auxiliary waterworks at Oaklands, some 5 miles from Ballymena, were formally inaugurated last week. The works will provide a supplemental supply of 400,000 gallons. The town has now a delivery of 1,500,000 gallons per day, equal to 3½ times the daily demand. The engineers for the new works were Messrs. Croasdaile & Swiney, Belfast, and the contractors Messrs. Ross & Son, Belfast.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL GENERAL MEETING.

The annual general meeting of this body will be held at the Holborn Restaurant, London, W.C., on Thursday, December 7th, at 2 p.m., when Dr. Samuel Rideal, F.I.C., F.C.S., will read a paper, entitled "Can Explosives be Manufactured on Sewage Works?" and Mr. Charles Terry, Canterbury, one on "Modern Sewage Purification Works: Their Design, Construction and Maintenance."

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have, we are informed by the secretary, Mr. Alfred R. Potter, been arranged as under:—

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., A.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Prof. S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffries (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act, with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

INSPECTOR OF NUISANCES.—November 27th.—Wigton Rural District Council. £150 per annum.—Mr. J. F. W. Ritson, clerk, West-street, Wigton.

SURVEYOR OF HIGHWAYS.—November 27th.—Wigton Rural District Council. £140 per annum.—Mr. J. F. W. Ritson, clerk, 4 West-street, Wigton, Cumberland.

TEMPORARY DIVISIONAL SURVEYOR.—November 29th.—Somerset County Council.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

WATERWORKS FOREMAN AND FITTER.—December 2nd.—Brumby and Frodingham Urban District Council. £2 per week, with 4s. war bonus. Mr. Alexander M. Cobban, engineer and surveyor, Council Offices, Frodingham, Lincs.

ASSISTANT SANITARY INSPECTOR.—December 4th.—Barnsley Town Council. £120 per annum.—Mr. W. P. Donald, town clerk, Town Hall, Barnsley.

SEWAGE FARM MANAGER.—December 4th.—East Barnet Valley Urban District Council. £2 10s. per week, with free house.—Mr. T. A. Buckley, clerk, Council Offices, Station-road, New Barnet.

ASSISTANT SURVEYOR.—December 8th.—Beeston Urban District Council.—Mr. George F. Greenwood, engineer and surveyor, Public Offices, Beeston, Notts.

ROAD FOREMAN.—December 8th.—Beeston Urban District Council.—Mr. George F. Grimwood, engineer and surveyor, Public Offices, Beeston, Notts.

DRAUGHTSMAN.—For Sandling Division, R.E., Kent.—Division Officer, R.E., Sandling, Kent Division.

STEAM ROLLER DRIVER.—Rotherham Rural District Council. £2 per week.—Mr. R. Bradbury, Imperial Buildings, Rotherham.

JUNIOR ASSISTANT TO BOROUGH ENGINEER.—Newark-on-Trent.—Borough Engineer.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WALLSEND.—December 4th.—For removing the existing corrugated iron roof of an elementary school and providing and fixing a boarding and felt roof, for the corporation.—Borough Surveyor, Town Hall.

Engineering: Iron and Steel.

WARRINGTON.—November 27th.—For the supply of a mild-steel shaft, for the Sanitary Works Committee.—The Manager, Longford Depot, Warrington.

RUNCORN.—November 27th.—For the supply and fixing of a heating apparatus, for the rural district council.—Messrs. Wright & Hamlyn, Sankey-street Chambers, Warrington.

BRADFORD.—November 30th.—For the supply of gas retorts, and of firebricks and fireclay, for the corporation.—Mr. C. Wood, gas engineer, Town Hall.

DUNFERMLINE.—December 8th.—For supplying and laying about 6 miles of cast-iron pipes from 20 in. to 9 in. diameter, together with the construction of incidental works, for the corporation.—Messrs. Crouch, Hogg & Easton, engineers, 14 Blythswood-square, Glasgow.

JOHANNESBURG.—December 9th—January 3rd. For the supply of 1,427 house service electricity meters, seven switchboard meters, and 100 time switches, for the municipal council.—Commercial Intelligence Department, 73 Basinghall-street, London, E.C.

SHEPSHED.—December 11th.—For the supply of a Cornish boiler and a horizontal steam engine, for the urban district council.—Mr. R. Smith, clerk, Shepshed, Leicester.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

DURBAN.—January 3rd.—For the supply of a 3,000-k.w. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation.—Electricity Department, Dock-road, Cape Town.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Iverell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

Roads.

WILTON.—December 1st.—For the supply of flints for the repair of the highways, for the rural district council.—The Surveyor, 12 Bridge-street, Salisbury.

TRURO.—December 5th.—For the supply of 200 cub. yds. of broken or unbroken spar, for the corporation.—Mr. F. A. Barnes, city engineer and surveyor, Municipal Buildings, Truro.

WILTS.—December 11th.—For the supply of granites, basalts, limestones, flints, hauling, steam rolling, tools for roadwork, and tar, for the county council.—Mr. J. G. Powell, county surveyor, Trowbridge.

Sanitary.

BEDWELLTY.—November 28th.—For the construction of 380 yds. of 12-in. stoneware service water drain, with manholes, for the urban district council.—Mr. D. H. Price, surveyor, Council Offices, Aberbargoed.

LLANDAFF.—November 30th.—For the construction of about 400 lin. yds. of earthenware and cast-iron pipe sewers, with manholes, for the rural district council.—Mr. J. Holden, engineer, Park House, 20 Park-place, Cardiff.

BOLTON.—December 4th.—For the supply of lime for sewage purification, scavenging brooms and handles, spades, shovels and forks, for the Cleansing and Sewage Committee.—Chairman of the Committee, Falcon-yard, Falcon-street, Bolton.

Stores.

KING'S LYNN.—November 27th.—For the supply of coal; oilman's goods, ironmongery, waste and packing, brushes, castings, disinfectants, stoneware pipes, timber, and plumber's work, for the corporation.—Mr. Alfred J. Smith, borough surveyor, Town Hall, King's Lynn.

NOTTINGHAM.—November 30th.—For the supply of cement, blue lias lime, red bricks, blue bricks, timber, stoneware pipes, iron castings, iron gullies, Yorkshire flags and kerbs, granite setts, broken granite, ironstone-slag, chippings, river gravel, coal, picks, shovels, scoops, ironmongery, scavenging, and other brushes, disinfectants, refined tar, pitch, and creosote oil, for the corporation.—Mr. Arthur Brown, city engineer, Guildhall, Nottingham.

Miscellaneous.

NORTHFLEET.—December 5th.—For the hire of horses and carts and slop-carts, horsing water vans, horsing sewage vans and tumbler carts, horses and carts for house refuse collection, and horsing the fire engine, for the urban district council.—The Surveyor, Council Offices, Northfleet.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

NOVEMBER.

28.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

DECEMBER.

5.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

8.—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.

7.—Association of Managers of Sewage Disposal Works: Annual General Meeting, Holborn Restaurant, London. 2 p.m.

12.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.

21.—Concrete Institute: Prof. Henry Adams on "Pile Driving and the Supporting Power of Piles." 5.30 p.m.

APPOINTMENTS OPEN.

SOMERSET COUNTY COUNCIL.

Wanted, Temporary Divisional Surveyor, to reside in Long Ashton. Must be over military age, and be fully qualified, experienced in the maintenance of heavily trafficked rural main roads, the control of mechanical tar-macadam plant, &c. Must be used to the control of men, and the keeping of detailed accounts and preparation of estimates. Necessary to be a motor cyclist, and £30 per annum will be allowed for the provision and upkeep of a suitable machine.

Applications, stating age, experience, salary required, and accompanied by three testimonials, to be sent to the undersigned before 29th November, 1916.

GORDON R. FOLLAND,
Acting County Surveyor.

Wells, Somerset.
November 9, 1916. (3,166)

BEESTON URBAN DISTRICT COUNCIL.

The above Council require the services of—

(a) Assistant Surveyor.

(b) Road and General Working Foreman.

Ineligible for His Majesty's Forces.

Applications, stating age, experience, salary required, and accompanied by copies of three testimonials, to be sent to the undersigned on or before the 8th December next.

GEORGE F. GRIMWOOD,
Engineer and Surveyor.

Public Offices,
Beeston, Notts. (3,174)

BRUMBY AND FRODINGHAM URBAN DISTRICT COUNCIL.

Wanted, a Waterworks Foreman and Fitter, temporary, whilst present foreman may be engaged on War Service; applicants to be ineligible for military service.

The appointment is temporary, and applicants must have been used to Crombes' ejectors, air compressor station (electrically driven), oil engines, sewage disposal works, the control of water distribution mains, fittings, and services. To be responsible for and run the plant, do all water fitting, electric wiring or repairs, and do all necessary running repairs. The plant comprises sewage works, ejector stations (2), pumping station, and the whole of the distributive water mains and services in the urban district.

Wages £2 a week with 4s. war bonus.

Applications, stating experience, and accompanied by not less than two recent testimonials, to be sent to the undersigned on or before Saturday, December 2nd, 1916.

ALEXANDER M. COBBAN,
Engineer and Surveyor.

Council Offices,
Frodingham, Lincs. (3,175)

EAST BARNET VALLEY URBAN DISTRICT COUNCIL.
SEWAGE FARM MANAGER.

The Council invite applications from suitable persons, ineligible for military service, for the position of Manager of their Sewage Irrigation Farm and Disposal Works.

The person appointed will be required to reside in the house provided by the Council on the Farm, free from rent, rates and taxes.

The salary will be at the rate of £2 10s. per week.

Applications, stating age, experience and other qualifications, together with copies of not more than two recent testimonials, must be sent to me, marked outside "Farm Manager," not later than 4 p.m. on Monday, the 4th December, 1916.

Canvassing in any form will be a disqualification.

T. A. BUCKLEY,
Clerk of the Council.

Council Offices,
Station-road, New Barnet.
November 22, 1916. (3,177)

POSITION vacant for Draughtsman in Sandling Division R.E., Kent. Reply, stating qualifications and previous experience, should be addressed to Division Officer, R.E., Sandling, Kent, Division. (3,172)

JUNIOR ASSISTANT (ineligible) wanted for general work in Borough and District.—Borough Engineer, Newark-on-Trent. (3,176)

TENDERS WANTED.

WILTS COUNTY COUNCIL.
MAIN ROADS UNDER DIRECT MANAGEMENT.

The Roads and Bridges Committee of the Wilts County Council invite Tenders for a period of one year, commencing 1st day of April next, for the following:—

Granites, Basalts, Limestones, Flints, &c.
Hauling—Piece Work and Day Work.
Steam Rolling.
Tools for Roadwork.
Tar for Tar-spraying.

Specifications and Forms of Tender can, on application, be obtained from the County Surveyor.

Sealed Tenders, addressed to the Clerk of the County Council, County Offices, Trowbridge, must be delivered on or before the 11th day of December, 1916.

No pledge is given that the lowest or any Tender will be accepted.

(By order)
J. GEORGE POWELL,
County Surveyor.

County Surveyor's Office,
Trowbridge.
November 15, 1916. (3,170)

BOROUGH OF KING'S LYNN.
The Corporation invite Tenders

For the Supply during the Twelve Months ending 31st December, 1917, of the following:—

Coal, Oilman's Goods, Ironmongery, Waste and Packing, Brushes, Castings, Disinfectants, Stoneware Pipes, Timber, Plumber's Work.

Forms of Tender and further particulars can be obtained, and Samples may be seen, on application to the undersigned, to whom Tenders must be delivered not later than 10 a.m., Monday, November 27th, 1916.

The Corporation does not bind itself to accept the lowest or any Tender.

ALFRED J. SMITH,
Borough Surveyor.

Town Hall,
King's Lynn.
November 9, 1916. (3,161)

APPOINTMENTS WANTED.

EXPERIENCED MUNICIPAL ENGINEER, City Engineer in British Colony, desires to return to England. Recent works—design and construction of 50 miles of sewers, large trunks and outfalls; water supply, 17 miles pipe line, delivering seven million gallons daily, reservoir, &c.; extensive street improvements; general administration. Fully qualified. First-class testimonials. Married. Apply Box 1,590, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,137)

MACHINERY AND PLANT.

PLANT FOR HIRE.

FOR HIRE—Several Steam Tractors and Two Light Traction Engines; all with, or without, trailers. Also one 5-ton Steam Motor Wagon. All in thorough condition. Town or country work.—For terms, apply Taroads Syndicate, Limited, 9 Victoria-street, Westminster. Telephone, Victoria 6850. (3,173)

A Bargain you will see through

IT IS GLASS!!

Glass in stock at Birmingham, Bristol, Coventry, Droitwich, Leicester, London, Porthcawl & Weymouth. All offered without engagement until we accept your order.

100 ft. boxes of specially good glass 15 oz. to 19 oz. This brand is being sold principally for picture framing.

The following sizes are in stock at time of writing, but it is advisable, when ordering, to specify one or two alternatives in case any are exhausted.

30 in. by 28 in.	28 in. by 26 in.	24 in. by 24 in.
30 in. by 26 in.	28 in. by 24 in.	24 in. by 22 in.
30 in. by 24 in.	26 in. by 24 in.	24 in. by 20 in.
30 in. by 22 in.	26 in. by 22 in.	

Price **3¾d.** per ft. This lot is exceptionally free from breakage.

100 ft. boxes of glass suitable for Horticultural and similar purposes, 18 in. by 14 in., 19 in. by 14 in., 18 in. by 16 in., also a Special Line for Army Hut Windows, 18½ in. by 13½ in. (reckoned as 19 in. by 14 in.) **3½d.** per ft. taking 6 boxes or more.

100 ft. cases of 21 oz. to 26 oz. glass in large sheets of good quality at 5½d. per ft. We deliver free (within certain limits) in the United Kingdom on £5 lots or more.

All offers at Buyers' risk as to breakage.

WHEELBARROWS. Navvy, strong hardwood Body, Iron Wheel, 15s. 6d. each. General purpose (Bonded Wooden Wheel), 21s. each. Carriage paid some stations taking a dozen.

C. JENNINGS & CO., Ltd.
TIMBER MERCHANTS, GENERAL WOODWORKERS,
838 Pennywell Road, BRISTOL.

The Surveyor

And Municipal and County Engineer.

Vol. L. DECEMBER 1, 1916. No. 1,298.

Minutes of Proceedings.

Water Waste in Calcutta.

True economy does not result in the cutting down of necessary expenses. On the contrary, the immediate and future results of indiscriminate saving and the aimless manner in which all kinds of necessary expenses are being cut down at the present time, lead to a great waste of money and energy. The only way in which economy can be secured is by the use of knowledge, experience, and brain power. Only by exercising careful thought can any real and lasting saving be accomplished. The unthinking administrator might, for instance, propose to effect a saving in water-works expenses by limiting the supply, whereas the engineer can often take steps which will save waste and thereby effect a much greater saving at the same time providing a larger supply per head in the district. This is no exaggeration, and we have a case in point in the report by Mr. J. B. Williams, sanitary engineer, Bengal, upon the Calcutta water supply which appears elsewhere in these pages. In this case the engineer is not dealing with any suggested measure of economy. He is merely showing that the proposal to increase the existing supply is unnecessary, and that if proper attention is paid to the question of waste an ample supply already exists.

This is a very good example of the manner in which public money may be saved by dealing with the question on a proper scientific basis. To the layman the problem appears to be quite simple. The supply is insufficient; therefore it is imperative that it should be increased. That this increase will mean a large outlay of money at a time when it is our duty to save is regrettable, but the troubles which are likely to follow a shortage of water are too great to make the saving possible. The engineer can, however, show that an enormous percentage of the water is lost owing to leakages and waste. His experience enables him to state what is an ample supply per head under the special conditions of the case, and he knows that such a supply exists at the source. He further is able to demonstrate how the waste may be stopped. The profession of water on the lavish scale which is common in American cities is misleading, and is obviously the result of rank stupidity and bad work. The extraordinary folly of providing, say, 200 or 300 gallons per head, of which perhaps one-tenth is usefully applied and all the rest runs to waste, is obvious, and it reflects seriously upon the mental condition of its advocates.

Calcutta is not the only place in which similar economy may be effected. We have drawn attention before to the extraordinary waste of money which is continually taking place owing to the construction of works which would be quite unnecessary if water supply problems were dealt with scientifically. There is a certain mental slothfulness leading to the most extraordinary waste in all directions, and it is the business of the engineer to deal with it. Mr. Williams has done good work in the case of Calcutta, and if those who read his report have the power of understanding it he will deserve the thanks of his district for saving them from a large and unnecessary outlay. The chief difficulty with which the engineer has to contend at the present time is that, though he may prepare reports and schemes, which, if acted on, will result in the economy of which we hear so much, he cannot provide his committee or board or the general public with the brains to understand them.

Fuel Waste.

Although something has been accomplished in recent years towards attaining the ideal of a smokeless city, a long distance has still to be travelled before that ideal can be said to be approaching realisation. It may be, however, that in regard to this problem, as in the case of many others, the exigencies of war conditions will hasten a solution. Addressing the members of the Leeds Luncheon Club the other day, Mr. S. F. Dufton, D.Sc., chose the striking subject "A Smokeless Leeds with £500,000 a Year Profit." This amazing result can be brought about simply and solely by distilling all coal before burning it. To quote Mr. Dufton's striking figures, this country imports nominally 100,000,000 gallons of petrol annually, while in the same period five times this quantity are sent up the chimney. And this is only one of the by-products of coal wasted in the riotous combustion of the open fire. The ammonia is still worse, for ammonia if burnt gives out no heat. Moreover, it is a vital necessity in farming, and every ton of coal might yield 2s. worth of ammonia if distilled. The simple fact is that at present from £40,000,000 to £50,000,000 worth of recoverable ammonia are sent up the chimney every year with no return at all, and a quarter of this could be easily retained by low-temperature distillation. It may well be that the increased cost of raw fuel, owing to the war, coupled with the rapid strides made by the internal combustion engine, will do more towards directing public attention to the wasteful and unhygienic qualities

of the open coal fire than years of propaganda could accomplish.

Apart from the wanton waste of valuable by-products which is inseparable from the burning of coal in open fires for the purpose of domestic heating, the necessity for economy in coal consumption is being brought home to the general public by high prices. The article by Mr. H. G. Coales, of Market Harborough, dealing with the utilisation of ashbin and other refuse for making cheap fuel briquettes, which will be found in another column, is therfore of special interest just now. Some years ago Mr. Coales patented a process for making "coalesine fuel" from ordinary ashbin refuse as brought by scavengers' carts to the manufacturing depot. This was to be converted, by a process of pulverisation, mixing with pitch and tar, and compression, into briquettes having a calorific value of from 28 to 41 per cent of that of coal. The gross cost of manufacture is from 4s. to 9s. per ton, and if sold at from 6s. to 11s. the briquettes would not be uneconomical, and would undoubtedly do much to meet the urgent present demand for cheap fuel. As Mr. Coales points out, it may well be that a Fuel Dictator will become necessary, and that he will feel obliged to look at every source of heat, including usable waste products. The whole subject is of pressing public importance and interest.

* * *

Safety First.

Probably at no time have the streets of our great cities, and particularly of the Metropolis, been so dangerous for foot passengers as they are to-day. This is due not only to the great increase in the number of high-speed vehicles, but also to the orders that have been made in regard to restricted lighting since the outbreak of war. A fairly accurate gauge to the direct result of the absence of adequate lighting may be obtained by comparing the accident statistics of the years 1914 and 1916. In the first nine months of the former year there were 411 fatal street accidents in the Metropolitan area, while the number rose to 577 for the same period of 1916. It is, of course, impossible in present circumstances to suggest any remedy in the nature of increased lighting, nor can any decrease in the volume of fast motor traffic be looked for. The immediate step to be taken, therefore, seems to be the education of drivers and of the general public in the best methods of minimising the dangers and risks which must arise from existing conditions. For some time past the London General Omnibus Company has been conducting a "safety first" campaign, and it is now felt that the situation calls for the closer co-operation of public authorities, companies, and private firms with a view to further and united action in the same direction. Accordingly, a conference is being held to-day, at the invitation of the company, with a view to the appointment of a "safety first" council to deal with various aspects of the matter. The conference will be thoroughly representative in character, invitations having been issued to local authorities, police, road users' organisations, traffic trade unions, and the leading traffic and transport companies. Of course, the details of the action to be taken to secure the desired ends have not as yet been definitely decided, but certain suggestions are made in the circular convening the conference. These include courses of instruction for traffic and transport employees; organisation of street traffic with a view to greater public safety; the preparation of schemes with regard to refuges, and warnings on lamps; and publicity, including cinematograph films and an exhibition. In view of the great importance of the matters to be discussed, it is to be hoped that there will be a general response to the invitations that have been issued, and that the primary object—namely, the formation of a council—will be achieved.

* * *

Payments to Officials on War Service.

Some confusion seems to have arisen in the minds of many local authorities and officials as to the effect of the Local Government (Emergency Provisions) Act, 1916, upon pre-existing arrangements as to civil pay made between local authorities and their officials who are absent on military service. It may be of service to our readers, therefore, if we briefly set out the position as we understand it. In the first place, it is clear from the express provisions of sec. 1 (1) that, as regards those who have joined the Colours since the Act was passed —*i.e.*, since May 17, 1916—the payment made by the council must not, without the sanction of the Local Government Board, exceed the sum necessary to make up the Army pay and allowances to the amount of the official's ordinary civil remuneration. As regards officials who joined the Colours before the Act was passed, however, the position is modified by the provisions of sec. 1 (2). That sub-section provides, first, that the section shall apply to officials who joined up before the Act was passed with the sanction or permission of their authorities, and "any resolution, promise, sanction or permission, passed or given by a local authority to any such officer or servant with a view to his serving in or with His Majesty's Forces, shall be binding on the local authority to the extent, and only to the extent, to which it could have been passed or given if the provisions of this Act had been in force." This is followed by a proviso, however, to the effect that, where payment has been promised in excess of that provided by the Act, such payment shall be deemed to have been lawfully made up to May 17, 1916, or such later date as the Local Government Board may determine, and the board may further sanction the continuance of such payment if they are satisfied that the man joined the Forces in reliance on the promise and the amount of the excess is not unreasonable. The effect of the Act has been to define a situation which was none too clear before, and it must be borne in mind that its provisions must be applied in addition to the considerations which led to the decision in *Budgett* v. *Stratford Co-operative Society*, 32 T.L.R., 378, in any case which concerns a modification by a local authority of the terms on which an official joined the Forces.

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Road Tarring and Fisheries.

The Salmon and Trout Association have arranged for an inquiry into the effect of road tarring on fisheries in various parts of the country. The inquiry will involve important and interesting issues, and it is to be hoped that it will be conducted in as comprehensive and thorough a spirit as it is possible to be. The subject demands careful and unbiassed examination alike on behalf of road-makers and the fishing industry, including that branch of it that is mainly sporting. It is rather curious to find, in regard to a problem that has aroused a good deal of feeling occasionally, that there does not appear to have been a case in which the alleged damage to fisheries from road tarring has been the subject of a legal decision on its merits. Several cases which have been before the Courts have been settled out of Court on lines that certainly suggested legal liability, but no considered judgment has yet been given that would be regarded as authoritative or serve as a legal precedent with respect to the specific question of injury from road tarring. Laboratory experiments, which, of course, are not conclusive or capable of general application, have provided

evidence that certain forms of tar are injurious to fish life if they reach the water in sufficient quantities, and this applies alike to refined and crude tars. It may be remembered, as a writer in the *Field* suggests, that not the tar itself, but the conditions of a tar-sprayed road which has been made impervious to moisture to the side to side, may serve as a medium of pollution in circumstances where levels and fall indicate a speedy entrance of road-washings to a stream or lake. The article in the *Field*, which is characterised by a welcome moderation in tone, returns upon the desirability of leaving stretches of road absolutely untreated in some conditions, and not carrying the tarring process out on every mile of a district for the sake of uniformity. These and other precautionary steps belong to the category of remedies that are more or less obvious; they are certainly well within the cognisance of road surveyors, but the necessity for them will largely depend upon the result of the inquiry which the Salmon and Trout Association have entered upon.

Waste Utilisation.

One of the minor results of the war has been the great increase in the number of disused tins that have been thrown on to the national rubbish heaps, coupled with a much greater difficulty in disposing of them profitably. The increase in the quantity of this waste material is of course principally due to the enormous consumption of tinned foods by the Army, though there has probably at the same time been a general increase in the use of these articles of diet on account of the higher prices of fresh food. As regards disposal, before the war there was a considerable export trade with Germany, where the tin, spelter, and solder were extracted. To-day, on the other hand, with this means of disposal abolished, much valuable metal is being given or thrown away by local authorities, thus causing a direct waste which the country can ill afford, and which it is hoped may soon be stopped. Recently a special process, references to which have already been made in these columns, has been devised for extracting the pure tin from the metal and utilising the residue for the manufacture of small articles of general utility for which it is suitable. This process is being exploited by the British De-Tinning Company, which has already entered into contracts with three large boroughs for the erection of works within their borders. It is further proposed to set up central plants in suitable districts so as to enable small authorities to co-operate in taking advantage of the process, and the terms upon which these bodies will be enabled to use the process will form the subject of discussion at the three days' conference which will open at Caxton Hall, Westminster, on the 13th inst., and in regard to which a special announcement is made in our advertising pages this week. The conference in question will be attended by members and officials of local authorities from all parts of the United Kingdom, and promises to be an unusually interesting gathering.

One for the Tramways.

In these days when the comparative merits of motor omnibuses and tramways are the subject of continual discussion, any definite point that can be urged in favour of either type of vehicle is not without interest. On a recent evening there prevailed in London one of the densest fogs experienced in recent years, and this was accompanied by the usual traffic disorganisation. The Highways Committee of the London County Council are evidently proud of the way in which the tramways came through the ordeal. On the occasion in question a great deal of the traffic was brought almost to a standstill, and the reduced lighting contributed in no small measure to the difficulties that occurred. Nevertheless, the Highways Committee report that, notwithstanding these difficulties, the car services on the council's tramways were well maintained, the tramcars, by reason of the certainty of their route and direction, having fewer difficulties to contend with, in comparison with other forms of road traffic, when fog prevails. The committee say further that there can be no doubt that the manner in which the tramways service was maintained on the evening referred to was of considerable advantage to the travelling public, many of whom, but for the tramways, would have experienced the greatest difficulty and delay in travelling through London under the weather conditions then prevailing. It certainly appears that the trams scored on this occasion, at any rate, not in spite of, but because of, the necessity for their travelling along a fixed line of rails.

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Surveyors and Petrol.

At a recent meeting of the Malmesbury Rural District Council an interesting discussion was raised upon a proposal to grant a war bonus to the surveyor to cover the increased cost of petrol used in the council's service. The opportunity was seized upon by certain members to make insinuations of a general character upon the surveyor's experience and competence, one member going so far as to say that "this council took him in and educated him into the mysteries of surveyorship." We have no doubt that the surveyor is duly grateful for the council's philanthropy, nor that his technical education under such masters has been singularly complete. The fact remains, however, that he is using his motor cycle continually in the discharge of his official duties, and that the cost of petrol—not to mention tyres and sundry other matters—has gone up enormously in consequence of the war. In the circumstances, ought the increased expense to be borne by the council, who have the benefit of the cycle's service, or by the surveyor? In common justice there can be but one answer to this question, and we are glad to observe that the council came to a proper conclusion, although by the narrowest possible majority. We are led to draw attention to the matter here, as we regard it as one of principle, and further, because we feel that other surveyors may be in danger of unjust treatment in regard to it.

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Motor Chars-a-bancs and Petrol.

An important announcement has just been made by the Commercial Motor Users Association on the question of the use of petrol in chars-à-bancs. The Rapid Motor Transport Company, Limited, of Glasgow, who are members of the association, were summoned, under the Defence of the Realm Act, for using petrol for the purpose of heating the engine of a char-à-banc. Evidence was produced to show that, although petrol was used to heat the engine prior to the commencement of the run, the actual run was made on paraffin. The Procurator Fiscal contended that this came under the Prohibition Order, but the sheriff held a contrary view, and acquitted the accused. The Procurator Fiscal immediately appealed against the decision, and the association took the necessary steps to support its members, the case being down for hearing before the Justiciary Court at an early date, but the Procurator Fiscal has now intimated that the appeal will not be proceeded with. The association has been advised that the appeal would not have been withdrawn except on the instructions of Crown Counsel, and the result, therefore, in their view, is an authoritative decision that petrol may be used for heating paraffin engines on chars-à-bancs without infringing the regulations.

C

Utilisation of Ashbin and other Refuse.

CHEAP FUEL BRIQUETTES.

By HERBERT G. COALES, ASSOC.M.INST.C.E., F.S.I., Engineer and Surveyor to the Market Harborough Urban District Council.

The fact is at length dawning upon the minds of most people—though not on all—that the country is engaged in a big war. Prices of food, clothes, fuel, and so forth, are much enhanced by reason of the war conditions. At such a time it behoves those in authority—and for the matter of that the ordinary civilian too—to make the most of the available supplies of the various necessities and commodities of life.

It is proposed in this article to deal with the question of fuel—and one side only of this big industry. It is an old string upon which I wish to harp—viz., the utilisation of refuse as fuel. Some years ago I went very carefully into the matter, made many experiments, and carried out very close investigations. Having arrived at a satisfactory conclusion, I took out patents for a process, and made known the new fuel, which I called "coalesine fuel." I received very flattering comments from the Press, and really quite an interest was aroused. But when it came to floating a company to work the patents—that was another matter! The time was after the speculation fever had subsided, and people were not putting their money in English concerns to anything like the extent they had done years before. Another matter which at the time militated against the prospective success of the coalesine fuel manufacture was the continual mounting up of the cost of gas residuals—owing to the great increase in the use of tar on the roads and the purchase of pitch by the Germans.

To-day, while fuel is high, pitch and tar are low, as the following figures show:—

	1909.	1912.	1916.
Crude tar	22s.	35s.	20s.
Pitch	18s.	55s.	16s.

Before here putting into practical form the steps to be taken to utilise the waste products of our homes by conversion into fuel, I should like to say that I have no axe to grind, my patents having been allowed to lapse.

I have always believed that one good way to dispose of refuse is to burn it in the form of briquettes. The British public, however, when I was hammering away at the invention years ago, would not risk the initial cost of the plant, but it occurs to me that to-day the matter may be viewed with more favour, the conditions I have pointed out above obtaining. The fuel could be made at a cheap rate, and would show a flattering comparison with the cost of coal. But in addition to this, the putting of a new fuel on the market would relieve the effects of the shortage of coal, and help people to carry on more comfortably.

I think the most serviceable way of presenting the proposition, so that public authorities or persons may manufacture this coalesine fuel, if they so desire, is to deal with the matter under the following heads:—

(1) The source of the constituents of the briquettes.
(2) The process of manufacture of the briquettes.
(3) Grading the briquettes.
(4) The cost of manufacture of the briquettes.

SOURCE OF THE CONSTITUENTS OF THE BRIQUETTES.

It is estimated that 10,000,000 tons of ashbin refuse is produced annually in the United Kingdom. That part which is disposed of in refuse destructors, at a cost on an average of between 3s. and 4s. a ton (if all outgoings are brought in), is of course not available for briquette making, unless the destructors are disused; but the bulk of the refuse in the country is dumped, and has been dumped for years, on waste land a system to be deprecated on sanitary and, in my opinion, on utilitarian grounds.

It is quite obvious then that a very large accumulation of material of calorific value is already stored up in the immediate neighbourhood of towns. One cannot guess the amount, but if 25 per cent of the annual production is assumed, and this is multiplied by the number of years the tipping has taken place, it will be seen that very respectable potential coal mines are available to be worked up into briquettes. Under ordinary conditions it would generally be best to leave the old tips undisturbed, but in war time everything should be put in to conserve our coal supplies.

The ordinary source, however, for the briquettes would be the ashbin refuse freshly brought by the scavengers' carts to the manufacturing depot. In addition to this, nothing of calorific value should be wasted—coal-dust, sawdust, shavings, peat, garden refuse, and so forth should not be overlooked. We really ought to wake up, and utilise all our resources.

Ashbin refuse should not be totally condemned as a fuel—as it is by some—because it has a low calorific value; at any rate, it costs nothing, and the onus is on the local authority to cart the refuse somewhere. As is well known, crude ashbin refuse will burn in the dump if fed with discretion, while if the fine ash is screened out the remaining refuse will burn freely, and with a forced draught will produce steam in boilers. To my own knowledge a swimming-bath boiler and a brickyard works boiler were served by refuse in this way—the steam was forthcoming all right, but so, unfortunately, were smells from the shafts! Hence the necessity of putting the stuff into briquette form and deodorising it.

Tar and pitch are two constituents of briquettes, and, while not exactly waste products, the prices of them as shown above are very reasonable—less than the cost of coal.

Coal dust or smudge, added to the briquettes, enhances their heating value, and there are old dumps of this fuel at many pit mouths.

THE PROCESS OF MANUFACTURE OF THE BRIQUETTES.

Ashbin refuse cannot be briquetted in its crude state. The first operation therefore (after screening out the very fine ash) is to pulverise and disintegrate the refuse to a powder or fine material. There are several machines on the market capable of doing this pulverisation. To mention three, the Patent Lighting Crusher, the Williams Patent Crusher, and the "Carr" Disintegrator. The first-named crusher has been at work at Southwark for many years.

The powdered refuse is heated and delivered to a steam-heated revolving receptacle, where it is incorporated with a hot mixture of pitch and tar, which is run in from a steam-heated tank, measured quantities of the tar mixture and the refuse being charged into the receptacle intermittently. The plastic mixture is allowed to cool in a shallow pan, and is then briquetted, preferably in a machine of the well-known Yeadon type, having a revolving mould plate and means for compressing the material on both sides.

The incorporation of the tar and the pitch provide the enriching ingredients, the tar being in addition a deodoriser, and the pitch an agglutinate.

The coal dust or smudge is added to the powdered refuse before the addition of the tar mixture.

GRADING THE BRIQUETTES.

The calorific value of coalesine fuel is easily appreciated when put in the form of a proposition as follows:—

(*a*) Crude ashbin refuse will burn and make steam.
(*b*) When enriched with tar compounds it is necessarily fortified.
(*c*) When smudge or coal dust is added it is further improved.
(*d*) When half the incombustible material is screened out and discarded the fuel approximates to coal.
(*e*) The briquette form of the fuel lends itself to combustion better than many classes of coal.

It is evident from the above that the briquettes can be graded at will, the lowest calorific kind being a mixture of pulverised crude refuse mixed with the tar compounds, and the highest calorific kind being a mixture of pulverised refuse (after the fine incombustible ash has been screened out) mixed with coal dust as well as with the tar compounds.

The following calorific values must be borne in mind in settling the grade of briquette required:—

One pound of ashbin refuse will evaporate from 1 lb. to 2 lb. of water; average 1½ lb.

One pound of best coal will evaporate 8 lb. to 9 lb. of water.

One pound of coal smudge in the form of patent fuel will evaporate from 8 lb. to 9 lb. of water.

One pound of tar will evaporate 11 lb. of water.

Therefore 1 lb. of coalesine fuel will evaporate from 3¾ lb. to 5¾ lb. of water, or from 38 per cent to 71 per cent the value of best coal according to the grade.

The incombustible residue from crude ashbin refuse is 33 per cent (as against 5 to 10 per cent in coal). The incombustible residue from coalesine is from 10½ to 16 per cent, according to the grade.

Some of the coals sold to-day seem to leave considerably more ash than in normal times, and the ash from coalesine fuel would not seem excessive in comparison.

Unlike coal briquettes (e.g., ordinary patent fuel) coalesine briquettes burn with a good flame, as their composition includes substances of a good inflammable nature, and there is less smoke. In works boilers there is practically no smoke or smell; in fact, less than in many coal-fired boilers, the form of the fuel inducing a good draught in the interstices between the briquettes and producing perfect combustion. Fires of coalesine fuel can be started in domestic grates with sticks in the ordinary way. Smoke can be mitigated, if it arises to excess, by treating the fuel with the various preparations now on the market for making coal smokeless. The fuel is quite suitable for suction gas plants and for stoves. There is nothing whatever to prevent the briquettes being used with coal if desired.

THE COST OF MANUFACTURE OF THE BRIQUETTES.

The plant for dealing with 10,000 tons per annum would cost round about £2,500, but the class of machines, the buildings, and generally the type of installation would vary the cost considerably. Improvised plants with careful scheming could be erected at a less cost. It is evident that if only a few shillings a ton profit were made, the installation would pay for itself in a couple of years, and the risk could not be great.

The cost of manufacturing the briquettes would be from 4s. to 9s. per ton, according to the grade, bringing in all outgoings, the comparative cost of production being only from 28 per cent to 41 per cent that of coal. Therefore if the briquettes were sold at from 6s. to 11s. per ton they would not be uneconomical, and would meet an urgent demand for a cheap fuel. They would also be in a very convenient form for handling and storing, and quite free from smell.

In conclusion, it ought to be remembered that the disposal of a town's refuse costs something at present, the saving of which would be on the credit side of the briquette system of disposal, and make it comparatively still more advantageous.

If we could have a Fuel Dictator, most likely he would feel obliged to look at every source of heat, not overlooking the utilisation of what are misnamed "waste" materials. Incidentally, I should like to take such a dictator into the country, and have all the fallen trees, and the untallen rotten trees, and the dangerous and useless trees brought into the fuel supply—of course, as billets, not as briquettes! And what about peat? But that is another fuel "sideline" outside the scope of these notes. The question under discussion is: Are we to have briquettes from ashbin refuse?

CHEPSTOW WATERWORKS SCHEME.

The extension of the works of the Chepstow Water Company has become necessary in consequence of the construction of a new shipbuilding yard by the Standard Shipbuilding Company, the effect of which, it is calculated, will be to increase the population from 3,500 to 20,000. Some time ago the Chepstow Urban District Council were notified by the water company of their proposed scheme, and the statutory notice has since been given of their intention to apply to Parliament for authority to extend their undertaking. The works contemplated are of an extensive character, involving the laying of lines of pipes, and the construction of collecting and service reservoirs, rising main, collecting chambers, and water tower. The engineer for the Bill is Mr. Percy Griffith, M.Inst.C.E., of 20 Victoria-street, Westminster, S.W.

New Motor 'Buses for Lancaster.—At a meeting on Wednesday of the Lancaster Town Council it was decided to seek borrowing powers for the purchase of new motor 'buses, erection of plant, and contingencies.

LONDON WATER.

A NEW FORM OF TREATMENT.

"Of scientific interest and great practical importance" is the view of the Water Examination Committee of the Metropolitan Water Board with regard to the twelfth report of their director, Dr. A. C. Houston. The report deals with five subjects—circulation of water, water microbes, leather bacillus, sterilisation and resistance to filtration—and at the meeting of the board on Friday last the committee presented the following epitome of its contents:

CIRCULATION OF WATER.

The results seem to show that even in cases where the relative positions of "inlet" to "outlet" in a reservoir are possibly open to some criticism, the water at the "outlet" does not differ markedly in bacteriological quality from the water in other parts of the reservoir. It is suggested that this result is probably due to the improvement effected by storage being more rapid in the earlier than in the later stages, and also to the constant intermingling of the water throughout the reservoir. The results, however, do not point to the choice of position of "inlets" and "outlets" in reservoirs generally being a matter of small importance.

NOTE ON "WATER MICROBES."

The director considers that the foundation for a study of specifically infected waters should be based on accurate knowledge of the bacteria in water not contaminated with the specific microbes of water-borne disease. He shows, on a comprehensive basis, that there are very few microbes in the Metropolitan water supply liable to be mistaken (even provisionally) for the cholera vibrio, owing to their giving the so-called cholera red reaction, and that these few bacteria can, by the application of suitable tests, be readily differentiated from this pathogenic microbe.

LEATHER BACILLUS.

An interesting description is given of a coli-like microbe, which has been called "Leather Bacillus," owing to its affinity for leather. It appears to be the case that leather "washers" occasionally get into what is termed a "susceptible" condition, which is probably a state associated with age and decomposition. Under these conditions, it seems that certain microbes can live and multiply on the leather almost indefinitely. Fortunately, the experimental evidence adduced in the report is clearly against pathogenic microbes being able to multiply when brought into relation with "susceptible" washers. It is not suggested that leather washers should be abandoned, but only that care should be exercised in interpreting the result of samples collected from taps.

STERILISATION.

The director was the first person to sterilise a water supply (Lincoln, 1905), the Chicago experiments following some three years later. Since 1905 our knowledge of the subject has increased enormously, and in the United States sterilisation treatment is now so extensively adopted as almost to be the rule rather than the exception, as is still the case in this country.

Special attention is directed to Part II. of the sterilisation report, in which Dr. Houston describes a form of treatment which, with the co-operation of the engineering department, has been most successfully applied to the water of the river Thames at Staines (and also at Hampton). Briefly stated, the treatment consists in adding, at a cost of about 3s. per 1,000,000 gallons, a substance to the water which, in the dose employed, is absolutely innocuous. The effect of such treatment is to render the water *safer* than it if had first been pumped into the Staines reservoirs, and stored there for one or more months. As the cost of pumping 1,000,000 gallons into the Staines reservoirs is about 13s., and this treatment does away with the necessity for pumping, the saving during the months of June to September has been considerably over £3,000. During the winter months it will only be possible to carry out the treatment intermittently, owing to floods, but whenever it can be practised it means a saving of over £30 a day. It needs to be remembered that the saving has not been effected to the detriment of the consumers. On the contrary, Dr. Houston deliberately states that the water, as pumped to the consumers, has been even safer, as judged by the tests employed, than is usual, and free from any smell, taste, or noxious ingredient. The success of the treatment suggests the possibility of its being extended

to works where storage is deficient and filtration too rapid, thereby saving projected future heavy capital expenditure on storage reservoirs and sand filters. The treatment has been experimental and conducted as a war expedient. At this stage we do not press for its formal adoption as an established waterworks procedure by the board. If experience clearly shows that its routine use, even in post-war days, is to the advantages of the community, the board will doubtless empower the committees concerned to continue the treatment so long as they are satisfied as to its desirability.

We placed on record our high appreciation of the eminently successful work of Dr. Houston and his staff in devising and carrying out the onerous duties associated with so important an experiment, fraught with results of great scientific and economical value.

RESISTANCE TO FILTRATION.

The working cost of filtration is largely due to the necessity of periodically cleaning the sand filters. The life of a filter-bed is chiefly governed by the nature and amount of the suspended matters in the pre-filtration waters. A study of the suspended matters is more than a matter of mere scientific importance, and may conduce to more efficient and economical working of the filtration system. The facts presented in this section of the report are full of interest, both from a practical and scientific point of view.

LIVERPOOL SEWER CONTRACT.

THE CORPORATION v. W. MUIRHEAD & CO., LIMITED.

In the Chancery Division on Monday week, Mr. Justice Petersen had before him the action of the *Liverpool Corporation* v. *W. Muirhead & Co., Limited*, relating to a dispute between the parties as to the construction of a sewer in Liverpool, which was to be made by the defendants for the city council.

Mr. Maugham, K.C., and Mr. Courthorpe Wilson appeared for the corporation, and the defendants were represented by Mr. Walter, K.C., and Mr. Gover.

Mr. Maugham, who contended that the onus was on the defendants to prove their case, said (the *Liverpool Post* reports) the action related to a contract in writing dated August 10, 1914, under which the defendants were to construct a sewer in Liverpool, which was to connect two sewers, one of which had been recently constructed by the corporation itself, and the other which had been in existence for a very long time, and ran from the western end of the sewer. The defendants tendered for the work, and their tender for £17,432 was accepted. The contract of August 10th provided that the work should be completed within fourteen months. All disputes should be referred to arbitration, but the work should be done under the supervision of Mr. J. A. Brodie, or such other engineer as the corporation should appoint.

Clause 45 provided that if in the opinion of the engineer the work was not carried out by the contractors with due diligence, so as to enable the work to be completed in the time specified, the corporation might, by notice in writing under the hand of its town clerk, terminate the contract, and enter upon and complete the work, using all plant and machinery on the works for that purpose.

There was a provision for paying the contractors for the value of the work already done in the event of the corporation determining the contract, but the amount due was to be held by the corporation without interest for a period of twelve months after the completion of the work.

On July 22nd Mr. J. A. Brodie issued a certificate that the contractors had not proceeded with such diligence as would have enabled the works to be completed by the time specified, and on the same day, after the certificate had been given, the corporation, by notice in writing, determined the contract. Notice was duly served on the defendants on July 23rd, and on the same day the defendants sent a telegram threatening to resist any attempt to enter on or take possession of the works. The real question the court had to try was whether, under the terms of the contract, the plaintiffs were justified in putting an end to it.

Mr. Walter accepted the onus of opening the case, and said shortly the defendants' contention was that very serious disputes arose between the parties during the months of February, June, and July, 1915. Those disputes were to be referred to arbitration, but the corporation subsequently said arbitration was premature. Then while such disputes were still pending they acted under clause 45. The defendants counter-claimed for damages, but that did not come before the court at present, but would wait until the point in the action was decided. The work to be done consisted of making a sewer 3,300 yds., joining up the existing sewers. Counsel dealt with the correspondence, showing that Messrs. Muirhead discovered water in the rock through which the tunnel had to be driven, and were working under a head of water of between 40 ft. and 50 ft. The corporation denied any responsibility, but informed the defendants that if they had any complaint to formulate it in writing, so that it could be referred to arbitration. There could be no question that the corporation had kept them at arm's length with regard to arbitration, but had chosen to act upon a certificate which was not in accordance with the terms of the contract; that was the issue between the parties, and in that he submitted they were wrong. On the authorities they were not entitled to act on the certificate the very next day as they had done. Counsel contended that the contract provided for an award under the Arbitration Act, which could be tested in a proper manner. The issue between the parties was whether the certificate was a certificate under clause 45 of the contract or an award, and, secondly, if it was merely a certificate, was it final and binding upon the parties ?

The evidence engaged the attention of the court during the remainder of the week, and on Monday last a consultation took place between the parties out of court.

Mr. Walter, K.C., representing the defendants, said terms had been come to by which there would be a declaration and injunction as asked for in the statement of claim, with costs, and the defendants' counter-claim would be dismissed with costs. There would be a complete withdrawal of all charges of misrepresentation, all claims under the contract would be abandoned, and the securities would be released. The plaintiffs were to retain the plant and materials which they had taken possession of, and were to pay to the defendants the sum of £2,500, which was the balance due after crediting the plaintiffs with £2,000, the amount at which the costs had been agreed, and an agreed sum for damages. It had been suggested that it might be thought that there was some charge against Mr. Brodie, the corporation's engineer, and he desired to say no such charge was ever made, nor was such a charge ever intended.

Mr. Maugham, K.C., on behalf of the Corporation of Liverpool, desired to say that if the case had gone on he should have called a number of very eminent engineers, including Sir Maurice Fitzmaurice, whose evidence, he thought, would have satisfied his lordship that this contract was one that could have been carried out. He desired to make the statement, as it might appear that there was some reflection on the corporation in putting an end to the contract as they had done.

His Lordship expressed his satisfaction that the parties had been able to arrive at a settlement, and made an order in accordance with the terms agreed upon.

REFUSE COLLECTION AND DISPOSAL IN BELFAST.

In the city of Belfast there are about 82,550 houses. Of these 56,847 have been provided with galvanised bins (corporation bins, 50,248, and private bins, 6,599) for the reception of house refuse, and about 2,000 have other movable receptacles and 23,703 have ashpits.

The refuse is removed from the houses supplied with bins at least once a fortnight, and in some cases weekly. From those which have ashpits a period of from six to eight weeks elapses between the cleansings, while the refuse from the central and business portions of the city is removed daily.

In the annual report of the medical superintendent of health, Dr. H. W. Bailie, it is stated that the number of cleansings of ashpits and ashbins was 2,394,901, and the number of loads removed during the year 88,278.

The average cost of each cleansing of each ashpit or ashbin was 2d., and that of the removal and disposal of refuse per load, 4s. 11d.

During the twelve months under review 16,035 loads of refuse were burned in the destructor, at an average cost of 2s. 8d. per load.

Institution of Civil Engineers.—At next Tuesday's meeting of this body, Mr. P. M. Crosthwaite, M.INST.C.E., will submit for discussion a paper entitled "Experiments on Earth Pressures."

The Use and Waste of Water.

CALCUTTA'S HIGH CONSUMPTION.

By G. B. WILLIAMS, Sanitary Engineer, Bengal.

In the following note, prepared for the information of a sub-committee of the Calcutta Corporation appointed to consider the question, Mr. Williams makes the startling assertion that the amount of water wasted in the city is proportionately as great as, if not greater than, that in any other town in the world—a few American cities excepted.]

In discussing the question of the use and waste of water in Indian towns I have frequently had to refer to a fallacy that prevails, that, because in certain European and American towns the consumption of water per head reaches a high figure, and because many of the towns of them situated in temperate climates, therefore an even higher consumption per head is permissible in the towns in this country, which suffers from a tropical climate, and in which people may be expected to use more water for bathing and drinking.

Comparisons with the consumption of water in England or America are entirely misleading unless it is understood that the conditions in India with regard to water supply are fundamentally different from those in the former countries. That this is so will be easily appreciated, if the way in which filtered water is distributed and the purposes for which it is used in an English town are briefly considered.

MISLEADING COMPARISONS.

In the first place, of the water supplied to the latter, a considerable portion, sometimes a third or even one-half, is supplied for trade purposes. In Calcutta very little water is used for trade. The large jute mills and other manufactories around Calcutta have their own water supply plants. If the Calcutta Corporation supplied water to all the jute mills, cotton mills, paper mills, engineering shops, &c., in the neighbourhood for every purpose for which they require it, the increase in the total water consumed would be very great. But this is the position of an English manufacturing municipality, except that in many such towns the consumption for trade purposes is proportionately much greater than it would be in Calcutta.

Secondly, the water supplied in England is for every purpose, road watering, garden watering, sewer flushing, public conveniences, private water-closets, as well as ordinary domestic use. For all the former in Calcutta there is an ample unfiltered water supply, amounting to about 25 gallons per head.

Thirdly, in all Bengal towns (although less in Calcutta than in other towns) a considerable number of the inhabitants bathe in tanks and rivers, and do not require much filtered water for ablutionary purposes. It is not necessary to discuss here whether or not bathing in tanks is a practice which is a desirable one from a sanitary point of view; it is sufficient to say that it is quite certain that, so long as there are numerous tanks in and around the towns in this country, people will continue to bathe in them. In most English towns, except those on the sea coast, there is no possibility of bathing except in water from the public water supply, and in any case a person who bathed in the sea or in a river in England, except in summer time, would require to possess a very hardy constitution.

Fourthly, the loss from leakage of mains should be greater in English towns than in Indian, because the ordinary pressure in the former is usually considerably higher than in the latter country, and also because the length of distributing pipes for a given population is generally greater in England than it would be in India. As this is not always appreciated even by Indian waterworks engineers, I may mention that an average number of persons per mile of distributing pipe in an English town is somewhere from 500 to 1,000. This may be compared with the following figures for some of the towns in Bengal. In Howrah the average population per mile of distributing pipe is about 2,300; in Dacca, 2,800; in Mymensingh, 2,200; in Burdwan, 1,800; and in Darjeeling, 1,000. The population per mile of filtered water distribution piping in Calcutta is nearly 2,500. A leakage of half a gallon per foot of distributing pipe per day—a reasonable amount to expect—would be 5 gallons per head in an English town. In an Indian town the same rate of leakage would in most cases represent only about 1 gallon per head of population.

DISTRIBUTION.

The most important difference, however, is in the way the water is distributed to the consumers. This will be understood from a comparison between Calcutta and London. The total number of consumers in the area supplied by the Metropolitan Water Board are 6,721,207. The number of separate services are 1,121,400, or about 1 to every 6 of the population. The number of house connections in Calcutta are 33,221, or about 1 to every 27 of the population.

In the London area every house has a separate connection; there are no outside standposts and taps. In Calcutta a large number of the inhabitants get their supply from outside standposts in streets or yards. These people do not draw more than an average of from 5 to 6 gallons per head from the standposts, whereas in many house connections the consumption per head is ten times as much or more. If the Calcutta house connections were in the same proportion to the inhabitants as they are in London, and no more restrictions were imposed on waste than at present, it may be safely said that the consumption would be well on towards an average of 100 gallons per head.

In the London area the average daily supply is about 36 gallons per head. When it is considered that in this is included the water used for trade purposes, for watering streets, watering gardens and parks, flushing drains, for private water-closets in almost every house, and that the water is turned on constantly day and night at a pressure sufficient to reach the highest buildings in London, it will be seen how small this amount is compared with the figure of about 40 gallons per head for domestic purposes only, which is at present being pumped into Calcutta.

REQUIREMENTS OF TROPICAL CITIES.

The unsoundness of the proposition that a tropical city necessarily requires much more water than a city in a temperate climate is shown by the case of Cairo. There we have the example of a city of about 650,000 inhabitants situated in one of the hottest and driest climates in the world, containing a large number of big modern hotels, which are crowded with visitors for part of the year. The average annual rainfall in Cairo is less than an inch—about one-sixtieth part of the Calcutta rainfall. The average daily consumption of water in Cairo during the last year for which I have the figures was about 11,340,000 gallons, or about 17½ gallons per head.

Before I leave this aspect of the question I may refer to the examples of the American cities, which are often quoted. It is true that in some American towns prodigious quantities of water are wasted. Presumably these cities are rich enough to afford it. In connection with the water supply of American towns it must, however, be remembered that the American gallon is only four-fifths of the imperial gallon, and so all figures for per capita supplies must be reduced in that portion. America also affords examples of the reduction in consumption effected by metering house-connections. I can find records of three large towns which have from 90 to 100 per cent of the connections metered. These are the following, with the per capita consumption reduced to English gallons in each:—

Worcester: Population, 118,000; consumption, 56 gallons per head.

Fall River: Population, 104,000; consumption, 33 gallons per head.

Atlanta: Population, 90,000; consumption, 53 gallons per head.

These figures are, of course, high, and it appears that even in these towns there is a quantity of from 20 to 40 per cent of the water wasted, or at all events unaccounted for, but the consumption is very moderate compared with the following towns, in which the private connections are unmetered:—

Chicago	165 gallons per head.
Philadelphia	189 „ „
Buffalo	265 „ „

These latter figures show the appalling extravagance

that is possible in a water supply where there is no attempt to limit the consumption.

AN ECONOMIC QUESTION.

In the end the question of the quantity of water supplied is an economic one. Communities obviously cannot take more water than they can afford to pay for. In this respect the European municipalities have a considerable advantage over Indian ones. The rateable value of most English towns is between £4 and £6 per head of the population. The rateable value of the London Water Board area is £8·33 per head. The rateable value of Bengal mofussil towns averages about Rs.17 per head. In some of the mill towns on the Hooghly it is less than Rs.10 per head. The highest rateable values are at Kurseong and Darjeeling, where the figures are a little under Rs.50 per head. The annual rateable value of Calcutta in 1915 was Rs.4,17,63,880, the population being in round figures 900,000. This gives an average rateable value per head of about Rs.46. In other words, the rateable value per head of an ordinary English town is more than four times that of an ordinary Bengal town, and the rateable value per head of the London area is nearly two and three-quarter times that in Calcutta.

It is clear that, even allowing for the fact that waterworks cost somewhat more to construct and maintain in England than in India, the average English town can afford to give two or three times as much water per head as a town in this country for the same percentage of rates. I have no figures for the rateable value of American towns, but have no doubt that it is much greater per head of population than in England. The great wealth of the American towns possibly accounts for the indifference in that country to the water wasted in some of the large cities.

LEAKAGE FROM MAINS.

An effort has been made to show that of the water wasted in Calcutta a very large portion is represented by the leakage from the mains. The figures given for the waste appear, however, to me on the face of them to be quite incredible. It is stated that the water lost by leakage in distribution pipes inside the waste-water districts is 80,500 gallons per hour, or 1,932,000 gallons per day. The length of mains within these districts is 300 miles, so this works out to a leakage of about 6,500 gallons per mile per twenty-four hours. On the other hand, the leakage on the trunk mains is given as 5,147,716 gallons per day, which, in a length of 63 miles, is about 80,000 gallons per mile.

This figure is absolutely preposterous, and could not conceivably occur unless the water were running out at several points through large holes or through washout valves left open. Any such large discharges would certainly show either on the surface or be apparent in the sewers. . . .

We may, I think, at the outside put the waste by leakage from the trunk mains at double the rate per mile on the branch mains (in fact the rate is likely to be less), that is 13,000 gallons per mile, which would make the total loss per day from all the mains in Calcutta 2,800,000, or, say, 3,000,000 gallons per day.

INEQUALITY OF DISTRIBUTION.

Although the quantity registered in the waste-water meters is certainly considerably under the mark, the figures give us a fairly accurate idea as to the ratios between the rates of consumption in different parts of Calcutta, and, taking the records as they stand, the first thing that strikes one is the great inequality of the distribution of water in the city. This is, in fact, precisely what one would expect. Only a certain number of the inhabitants live in pucca houses, which are supplied with water through private connections, and the rest live in huts, which cannot be so supplied, and have therefore to go to standposts in the street for their water.

I have proved in many places that the people who get their supplies in this fashion do not draw more than an average of 5 or 6 gallons per head per day. In Calcutta there are 2,792 standposts, and, presumably, at least a third of the population get their water from these. It may safely be said that these 300,000 persons do not consume altogether more than 3,000,000 gallons per day, even including water wasted from standposts and used by them in public bathing places. If 300,000 persons take 3,000,000 gallons per day, it follows that, even taking the waste-water meter figures as correct, 600,000 persons must take about 25,000,000 gallons per day, or an average of 42½ gallons per head per day. This assumption is confirmed by the waste-water meter records for the separate districts. It appears from these that altogether about [illegible] persons have a daily supply which the consumption averages more than 35 gallons per head, and that in these districts the total quantity consumed is 16,600,000 gallons per day, or about 49 gallons per head. In the remaining districts the total consumption recorded by the meters is somewhat over 12,000,000 gallons per day, or about 21 gallons per head for 560,000 persons.

There is, in fact, no doubt whatever that the really serious waste is confined to a minority of the community, and that a large proportion of the inhabitants of Calcutta consume only a moderate quantity of water per head. It does not necessarily follow that any particular virtue attaches to these latter in this respect. Many of them do not waste water, because they have no opportunity of doing so. Water is not likely to be very seriously wasted through street standposts so long as they are in order and not tampered with. Unless a tap leaks seriously, or can be wedged open, it requires to be held open for the water to flow at all. No one is likely to go to this trouble for the sake of watching water run away to waste, and even a bath taken under a standpost in such circumstances would probably not take more than a very few gallons.

A reason for the unequal distribution of water in Calcutta has been suggested in the difference in pressure in different parts of the city. Undoubtedly, this has its effect, but it is really more in affording greater opportunity of wasting water in places where pressure is higher than in restricting the legitimate consumption in the areas of low pressure. From the table of pressures in various parts of Calcutta, it appears that in only comparatively few places the head of water is insufficient to reach the second floor of an ordinary sized house during some parts of the day, and there are not a large number of houses in the outskirts of Calcutta which are more than two storeys high. Apart from the increase in consumption that results from water being delivered to an upper floor instead of having to be carried there, the chief effect of a high pressure is that if taps are left running to waste they will discharge more water during the same length of time.

Experience in different towns in this country with a purely street standpost supply has shown me that in this class of supply the amount taken per head is little affected by the pressure. The only result of increasing the pressure is that the persons supplied draw the water they need in a shorter time. So far as I can see, in only very few parts of Calcutta is the pressure low enough to restrict the consumption to a point below what is really necessary.

Consumption figures per head, based on residential night population, are not strictly accurate, because in Calcutta, as in all big towns, numbers of people leave their homes during the day time and work in some other part of the town; also the total day population is larger than the night population on account of the people who live outside Calcutta and come in during the day. Although this daily migration to some extent increases the consumption of water per head in some areas and reduces it in others, its effect as a whole is not really very great. The larger part of the filtered water consumed is in the homes of the people; the amount used per head in the day time in the offices, shops, and works probably does not exceed a gallon or two. It would be interesting as an example to find out what is used by the corporation staff during office hours in the municipal offices.

DOMESTIC CONSUMPTION IN CALCUTTA.

I have made some observations as to the amount of water actually required in a house in Calcutta occupied by a European family of the better class. In the house I took as an example there were three Europeans, twelve servants actually resident, two horses, and one motor car. The baths were galvanised iron tubs, holding about 25 gallons when filled up to the top and about 10 or 12 gallons when filled sufficiently for an ordinary bath. As the hot water for such a bath has generally to be carried in kerosene tins, the average quantity of water used for a bath of this kind does not exceed 12 gallons. The following are the totals of the filtered water actually needed for different purposes, and the proportionate figures in gallons per head of the total resident inmates of the house:—

	Gallons per day.	Gallons per head per day.
Cooking, drinking, and washing of cooking and eating utensils	40	2·66
Ablution	150	10·00
Horses	20	1·33
Motor car	15	1·00
Total	225	15·00

The actual quantity used in such a house appears to be an average of about 350 gallons per day, or 23 gallons per head, but out of this a great deal is pure waste owing to taps at the compound or in the bathrooms being left running for longer than is necessary.

In the blocks of flats which have been erected during recent years the quantity of water used per head is greater, because of the oversized baths that have been installed in the bathrooms, and also because the number of European inmates is in a higher proportion to the number of servants. The quantity of water required in a flat containing four rooms, inhabited by two Europeans and two servants would be approximately as follows:—

	Gallons per day	Gallons per head per day
Cooking, drinking, and washing utensils	20	2·86
Ablution	150	21·43
Total	170	24·29

In a flat of this kind if the baths are allowed to boil to the overflow and run to waste, the quantity used may be double the above amount.

I have no doubt that for ordinary European establishments in this country 25 gallons of filtered water per head per day for all the inmates of each house, including servants, is ample. For persons living in hotels and flats where there are large baths, 30 gallons is sufficient. In Indian establishments the amount actually required must clearly vary with circumstances, but I am not prepared to believe that in the average of the houses more than 25 gallons per head per day is legitimately used.

I feel sure that in Calcutta the following quantities of filtered water represent all that is really used for any useful purposes:—

50,000 persons at 30 gallons per day	1,500,000
600,000 persons at 25 gallons per day	15,000,000
250,000 persons at 10 gallons per day	2,500,000
Supply to shipping, for non-domestic purposes, gowkhanas, stables, dhobies, &c., say	1,500,000
Permissible leakage from water mains, say	3,000,000
Total	23,500,000

or 25 gallons per head.

The rest of the water now used is, in my opinion, wasted in one way or another. The waste may be classified under one of the following heads: (*a*) Leakage from water mains or public hydrants and standposts; (*b*) water allowed to run to waste from private taps; (*c*) defective fittings in private premises. Of these, I have no doubt that the last two are the most important items.

CALCUTTA'S WASTED WATER.

The daily quantity of water delivered in Calcutta is about 35,500,000 gallons. Of this I believe that at least 12,000,000 gallons are wasted in one of these ways. The cost of coal stores, &c., used for pumping this water, together with the cost of filtration, appears to be about ½ annas per 1,000 gallons. This does not include charges such as establishment and supervision, which within certain limits are independent of the actual quantity pumped. At this rate the daily waste of water in Calcutta represents a charge on the corporation of about Rs.375 a day, or about 1,37,000 per annum. Moreover, as nearly all this water is turned into the sewers, the corporation has to pay for pumping it up again, and this represents a further substantial charge.

It has been suggested that, in addition to condoning this unnecessary charge on the city's finances, a further large expenditure of money should be made in order that the amount of water now wasted may be trebled. That is, the corporation is to embark on a large capital outlay, and in addition spend probably at least an extra 300,000 a year in pumping and filtering water in order that the community may turn all this water unused into sewers and pay for pumping it out of them again. If the ratepayers of Calcutta wish to spend their money in this fashion it is their business, but for any real benefit that will be derived the money so spent might just as well be taken and thrown into the salt lakes with the sewage.

CONCLUSION.

I have dealt with the question at some length in order to show as clearly as possible why I consider that the present high consumption of water is not really necessary. There is in fact no evidence whatever to show that this large supply is actually required, on the contrary it appears to me perfectly certain that it is not. The high consumption is, I am satisfied, not mainly due to leakage from the mains, but is almost wholly the result of extravagant use and waste of water in private house connections. The water thus wasted in Calcutta, when all the circumstances are taken into consideration, is, I am convinced, proportionately as great as, if not greater than, that in any other town in the world, with the exception of a few extravagant and wealthy American cities, and under the present system is wasted by a minority of the inhabitants who do so at the expense of the rest.

Before any large scheme for extending the water supply is considered, I consider that a very decided effort should be made to stop the present waste. In regard to this the chairman has recently made a suggestion which if carried out would, I think, give most valuable data to work on. At present there are about 3,000 meters in Calcutta, which are scattered all over the city, and many of which are on houses which show no excess consumption. These meters might be all concentrated in certain selected districts, and from the results obtained reliable information would be available as to the probable result of largely extending the meter system, and the effect of so doing, in reducing the consumption and consequent saving in working expenses, as well as to the income that would be derived from the water consumed in excess of the amount allowed for the ordinary water rates.

CLEANSING WORK AT CHESTERFIELD.

Some interesting information regarding the work of refuse collection and disposal at Chesterfield appears in the annual report of the medical officer of health for the borough, Dr. R. Fraser. The borough has an area of some 2,643 acres, with a population of 37,406, the rateable value being £149,909.

The amount of refuse removed during the year 1915 was 18,332 loads, against 18,991 loads for the year previous—a decrease of 659 loads, which is accounted for by the difficulty in obtaining labour towards the later months of the year, and to the enlistment of several of the regular men.

The destructor disposed of 13,141 loads, or 71·6 per cent of the refuse collected, the remaining 5,191 loads being tipped into disused clay pits. The committee, after considering the difficulty of obtaining labour and the increased price of horses, decided to try motor haulage and eventually purchased a Clayton steam wagon. This wagon arrived on December 28th, and is expected to assist in reducing the nuisance at Storforth-lane tip. This tip received the contents of 746 privy middens in the South Ward, and a similar class of refuse from an adjacent portion of the Central Ward. The motor wagon will enable a great portion of this midden refuse to be conveyed to the destructor, and so reduce the nuisance caused by the tip.

The addition of two cells to the destructor is urgently required, in order that all the midden refuse from the South Ward may be dealt with, and thus remedy this serious tip nuisance. The cost of collecting the refuse amounted to £2,691, against £2,557 for the previous year. The number of tenements from which refuse is collected is 8,632. The average cost per tenement was 6s. 2¾d., as against 6s. 2d. for 1914, the cost per 1,000 inhabitants being £67 5s. The cost in labour alone in emptying privy middens was 5s. 1d. per tenement, while that for ash-bins works out at 3s. 5d.

PRIVY MIDDEN CONVERSION.

The number of privies converted during the year was 134 against 243 in 1914. It has taken nine years to convert 1,000 privies into water-closets, a number which might have been reached this year had not the war broken out and prevented the Treasury from sanctioning the loan asked for the purpose of privy conversion.

Although there are still many privy middens in the town, which are a nuisance to the neighbourhood, it was felt that unless the nuisance was aggravated by a leakage, or the building rendered dangerous from want of repair, the conversion work should not be pressed too hard upon owners. Another trouble was the great increase in the cost of materials and the difficulty of obtaining labour. As the number of privies in the town is considered to be one of the chief factors in its unsatisfactory health condition, it is hoped that immediately the war is over a much greater effort will be made to reduce the time originally allotted to complete the work of conversion.

PLANNING OF ARTERIAL ROADS.

By Prof. S. D. Adshead.

[From third of series of lectures on "The Town Planning of Greater London After the War."]

In my last lecture I reviewed the history and development of main roads during a century subsequent to the introduction of railways, and showed how a century of science and administration had converted country lanes into important highways. Then for fifty years they were practically disused. Occasionally a furniture van would rumble along their once busy track, or perhaps a gipsy band, or farmer's trap. It was the strenuous cyclist who again put life into the road. It was the cyclist who investigated the meanderings of the country lanes. But the cyclist was not a man of influence, and his excursions not matters of national importance, and this of itself had very little effect on the deliberations of those responsible for the upkeep and improvement of main roads. The *régime* of the cyclist was of importance, however, as anticipating the automobile. The introduction and development of self-propelled vehicles, little more than a decade ago, was so important an event that we are justified in regarding it as a momentous incident in our national existence. It is creating, and will continue to create, a complete change in the organisation of popular transport. It is bringing about great changes in the distribution of factories. It is upsetting long-established land values. And its influence penetrates to the very placing and planning of the home.

The extraordinary rapidity with which the motor industry has been developed, both as regards pleasure vehicles, tradesmen's vans, and heavy wagons, demonstrates irrefutably that after the war (which has naturally produced a temporary check) we shall have such a resuscitation and revival of road traffic as has never been seen before.

Now, we must not forget, in considering the construction of a new road, the requirements of which are in the first place to meet the needs of motor traction, that we are dealing with quite a different problem from that presented to Telford and Macadam, whose interest centred mainly on the movements of the four-horse stage coach. If I were asked to enumerate the cardinal requirements of the main road of to-day I would mention:—

(1) An even surface with good grip.
(2) A wide angle of visibility.
(3) Big curves and no corners.

THE LONDON CONFERENCE PROPOSALS.

With regard to the Conference proposals for new arterial roads leading out of London, I am bound to point out that the conclusions arrived at are on the whole excellent; but, at the same time, through untoward circumstances, there are cases where the results are, to my mind, by no means the best. It must be borne in mind that the local authorities through whose areas the roads pass have had a good say in the matter, and there is no doubt that, in order to meet their wishes and obtain their consent to a scheme, modifications which have had to be made have not in every case been an improvement on the original line; however, this is exceptional, and not general.

And, moreover, I would point out that in regard to road construction and town improvements generally, as in other walks of life, there is the "broad" and "narrow" way. There are several cases where a fine scheme has been overlooked or abandoned for lack of—shall I say faith? Some of the proposals, as, for instance, the proposed circumferential route from Clapham to Catford, described as the "South Circular Road," are so tortuous and irregular that under no circumstances could they ever become great popular thoroughfares like the Haussmann roads in Paris. I realise, however, that in this case merely to connect up an existing series of roads was all that was ever intended. At the same time, if a main road is worthy the name, it must have distinction, it must be a wide, continuous track, showing no hesitation as regards its career; otherwise it is not a road, it is merely a route. Should it incline to the left or right, it should do so deliberately, and never appear to be slinking into a back street. Should it penetrate an important junction, it should do so with some formality, and not elbow its way through a maze of irregularities, only to be disposed of by following a tram track. And it should have characteristic and never-to-be-forgotten features at intervals in its course.

It is here that the services of the architect are required. It is the architect who alone can deal with road junctions and give them their proper setting. A main road should be so direct and deliberate that it is quite impossible consciously to slip away from it. And it is of importance to give consideration to the mental effect produced on the driver of a vehicle by disturbing elements in the planning of its course. I mean such features as turnings which create feelings of hesitancy, continual narrowings and widenings, and where two ways meet having to take what in plan and appearance is the less important of the two. So to plan a main road as to preserve the equanimity of a driver is, if anything, even more important than that it should be absolutely the shortest route.

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάνθ' ὁρᾷ
(One man does not see everything.)
—Euripides.

CONCRETE ROADS.

To the Editor of The Surveyor.

Sir,—It was with very much pleasure that I read in your issue of November 17th the notes which Mr. H. P. Boulnois has written under the heading of "The Future of Granite Macadam and Concrete Roads." When such an engineer on road construction as Mr. Boulnois has expressed an opinion like he has done on the question of reinforced concrete roads, I can see the time coming very rapidly when this class of road will be the standard adopted for road construction in this country.

Recently I had the pleasure and privilege of reading the "Proceedings" of the Second National Conference on Concrete Roads, which was held at Chicago in February last, and on this I have written a review, which was published recently in *Concrete and Constructional Engineering*.

Water-bound macadam roads are all right on some country roads where light and slow-moving traffic is concerned, but when one comes to the main county roads on which heavy and fast-moving traffic runs, this class of road is more or less a failure. Perhaps this word "failure" should be qualified by remarking that its failure consists in the cost of its upkeep.

I have had the greatest faith in reinforced concrete roads for the last six or seven years, and I am sure that they are the coming thing, not only as a wearing surface, but as a sanitary surface and a cheap means of construction. I am glad to see that Mr. Boulnois takes the view that through our failures we are likely to become successful. One can quite understand why the concrete road (which I take it is the Dover road) in some instances has failed. Under ordinary circumstances no engineer or surveyor should attempt (in this district at any rate) to lay concrete roads in the month of December. To my mind concrete road construction should never be attempted except between, say, the middle of March and the end of September; otherwise we are tempting Providence in a manner which we ought not to do.

I agree that 6 to 1 concrete for heavy traffic streets such as this road which has been constructed is too poor to stand the traffic which passes over it.

In the review which I had the pleasure of writing I laid great emphasis upon the fact that no concrete road work should be constructed at any time that would be likely to cause failures. I think expansion joints are not absolutely necessary in narrow roadways, although in the concrete roads which I have laid I have provided these; but in the future I shall probably leave them out and adopt the suggestion which Mr. Boulnois has made—viz., to lay alternate bays of concrete instead of taking the same all through in one mass. Tar-spraying or tar-painting I consider necessary.

It is also very interesting to note in the same issue of The Surveyor (p. 455) the cost of maintenance of the roads in Kent. If concrete roads were adopted this expenditure, to a great extent, would not be necessary; and if the main county roads generally were done with reinforced concrete I could see a saving of hundreds of thousands of pounds per annum on such roads in this country. Of course, engineers cannot expect concrete roads to last for ever, and must make up their minds the same as they do with wood-paved or granite-paved roads that after a lapse of, say, ten, fifteen, or twenty years the same may have to be re-surfaced.

Another item in the same issue and on the same

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page, pointing out that [illegible] roads are a failure, is that with regard to motor omnibuses, where I see that the Accrington Rural District Council have borrowed £350 as expenditure incurred for laying the roads in order for motor omnibuses. Here, again, if concrete roads had been put down this would not have occurred, and, as I have said in the review which I have written, it is up to all motor omnibus companies and owners of other mechanically propelled vehicles to agitate until they see something in the way of road construction that will not put any additional burden on them to pay contracts for damage done. We in England have got to face the fact that motor 'buses, motor cars, and other mechanically propelled vehicles are going to use our roads more than ever, and road engineers must face this question.

Now that Mr. Boorne has taken this matter up I hope he will give (as one of the vice-chairmen of the Roads Improvement Association) every assistance that he possibly can in helping to convince road engineers and surveyors that concrete road construction is the thing of the future.

Apologising for taking up so much of your time, but this question is one in which I am very keenly interested, and which I intend to carry out on an extensive scale in the borough of Chester.—Yours, &c.,

W. MATTHEWS JONES,
City Surveyor, Chester.

November 22, 1916.

ELECTRIC v. CABLE TRAMWAYS.

To the Editor of THE SURVEYOR.

SIR,—It is unfortunate, the case, as pointed out in your editorial columns last week, that the progressive city of Melbourne has to be bracketed with Edinburgh in this connection.

Long ago, conversion to an electric system would have prevailed had the "powers that be," when cables were a distinct advantage over horse traction, not shackled future development by giving to the concessionaires of those early tram powers that if cancelled before the termination of the concession period, would have rendered the grantors liable for such heavy compensation as to make conversion prohibitive. So, sooner than pay such compensation, Melbourne city is to-day suffering from the short-sightedness which permitted the concessionaires' tramways to pass into the hands of a syndicate, instead of retaining them as an asset for the whole of the citizens. I should think when conversion does come it will be on the underground system [illegible] tunnels are already excavated, properly finished for cable working.—Yours, &c.,

J. C. H.

[In our view it would be a grave misfortune for Melbourne to be saddled with the conduit system of electric traction. Owing to the enormous cost, this system can pay its way only where the traffic is exceedingly dense; nevertheless, the London tramways even before the war were in financial difficulties, and for the year ended March 31, 1914, showed a deficit of £88,526, without making any provision for renewals. The gross profit was £667,212, but the interest and sinking fund alone amounted to £736,597. If the overhead system had been used throughout there would have been a handsome net profit, as in Manchester, Glasgow, and other cases which have run smaller undertakings, but are exceedingly prosperous. Unfortunately, the Melbourne City Council have urged the Government to adopt the underground system if the cable tramways are electrified, and promises the strongest opposition to the overhead system. Our correspondent refers to the tunnels being already excavated, but the conduit used for cable traction is useless for electric traction, and the street surface would have to be ripped up to lay the electric conduits, involving a new concrete foundation. Finally, the conduit system is liable to many working troubles and costs from which the overhead system is free.—Ed. SURVEYOR.]

"EXTRAORDINARY TRAFFIC AGAIN."

To the Editor of THE SURVEYOR.

SIR,—Adverting to the article which appeared in THE SURVEYOR under the above heading last week, in connection with the Abingdon case, and the recent judgment in the Court of King's Bench, it may add additional interest to your notes if the fact were made known that the damages awarded to the Abingdon Rural District Council worked out, on the mileage run by the motor omnibuses and charas-à-bancs, at 3½d. per car-mile.—Yours, &c.,

WATCHFUL.

November 28, 1916.

THE ABINGDON EXTRAORDINARY TRAFFIC CASE.

MOTOR 'BUSES WITHDRAWN FROM DISTRICT ROADS.

As the result of the decision in the Court of King's Bench in the action for damages brought by the Abingdon Rural District Council against the Oxford Tramways Company, the company have at once changed the route of their 'buses in the Abingdon district. They now run to Abingdon *via* Wootton Village instead of *via* Boars Hill—that is, on the main roads under the care of the Oxfordshire County Council.

"Whatever we may think of the propriety of 'bus companies paying something towards the upkeep of the roads they use," says a writer in the *Oxford Chronicle*, "it is quite clear that after last week's decision the Oxford Company could not continue to run the risk of being mulcted in serious damages every time they ran a vehicle on the Abingdon Rural District Council's roads. They were bound to decide to leave their roads severely alone.

"The decision is, however, a very disagreeable one for the inhabitants of Boars Hill. When the 'bus company first started their services the people of Boars Hill were very active and insistent in urging them to bring the 'buses up the hill. Now it is said that certain residents in the district have been prominent in supporting the action of the rural district council. However that may be, the 'bus service is cut off, and people of the district are only carried to a point which leaves them a mile or more away from their homes."

Housing Needs.—At a largely attended conference of the National Housing and Town Planning Council, held at Manchester, a resolution was passed urging local authorities to ascertain the housing needs of their areas, and to secure control of suitable land. The conference also expressed the opinion that the legislation promised for the amendment of the Finance Act (1909) should be carried in order that house building might be stimulated.

Digestion of Activated Sludge.*

By HARRISON P. EDDY, Boston, Mass.

Among the industrial wastes disposal problems which have been troublesome in Massachusetts during the past decade is that of a large sheepskin tannery. While a satisfactory effluent can be produced by any one of several different methods, investigations have been carried out to determine, by actual test, their praticability and efficiency, with a view to ascertaining which is the best method for adoption.

These investigations have included the construction and operation for over a year of a trickling filter, and for nearly a year of an activated sludge plant. Both processes have been demonstrated to be applicable to the treatment of these wastes. The latter appears to require as much as 10 cub. ft. of free air per gallon of wastes treated, and that the aëration be continued for a period of about twelve hours. Quiescent sedimentation for two hours is required for efficient removal of the suspended matter after aëration.

Under these conditions the clarification and oxidation may be expected to be fully equal to, and probably better than, those obtained by a trickling filter 7½ ft. deep, operating at a rate of 750,000 gallons per acre per day.

The wastes used for these tests were first passed through sedimentation tanks, to remove the major portion of the suspended solids, in order to prevent the accumulation of a large quantity of very heavy matter in the aërating tank. The preliminary treatment also provided for equalising the quality of the wastes.

Because of this treatment the sludge produced by the activated sludge process consisted principally of substances which had been in colloidal or dissolved condition, and it may have been more susceptible to bacterial attack than sludge comprising the coarse suspended matter as well as substances precipitated from colloidal and dissolved condition.

The settled wastes were much stronger than average unsettled municipal sewage, as shown by Table I.

Table I.—Analysis of Settled Tannery Wastes and Unsettled Municipal Sewage.

Determination.	Settled tannery wastes Mar. 6—July 17, p.p.m.	Unsettled Worcester, Mass. sewage, p.p.m.
Oxygen consumed	702	193
Albuminoid ammonia	114	7·1
Total solids	2,740	582
Loss on ignition	635	429

The results of these analyses indicate that the tannery wastes, even after efficient sedimentation, were in a general way three times as strong as the municipal sewage of the city of Worcester. Furthermore, the wastes contained large quantities of fats, originating partly in the tannery proper and partly in the wool scouring department. The fats determined by extraction with ether amounted to about 140 p.p.m. In addition, about an equal quantity of fat was present in the form of soaps.

Sludge Accumulation Period.

The tests were began December 29, 1915, and while there was a gradual accumulation of sludge, it early became evident that the process of activating the sludge would be exceedingly slow, as the temperature of the wastes was below 50 deg. Fahr. The wastes were therefore warmed to about 70 deg. Fahr., by discharging live steam into the aërating tank for the necessary period of time. The quantity of sludge accumulated gradually until the end of the period, February 7, 1916, when it amounted to about 20 per cent of the normal capacity of the tank, equivalent to about 25 per cent of its influent capacity.

The sludge produced at first was similar to that resulting from plain sedimentation, except that it was less dense. When the treatment began to be effective the sludge became coarse and feathery in nature and purplish-brown in colour. Later it lost the purple colour and the flocks became finer.

During this period 11,030 gallons of sludge per 1,000,000 gallons of influent was produced and accumulated in the aëration tank. The results of analyses of samples carefully taken indicate that about 71 per cent of the organic substances removed from the sewage were unaccounted for by the analysis of the sludge.

Sludge Activation Period.

With a view to increasing the activity of the sludge, the contents of the tank, after being filled on February 7th, were continuously aërated until March 6th no wastes being introduced between these dates. The loss of organic matter during this period amounted to 40·7 per cent, the volume of sludge being reduced 62·4 per cent. It is somewhat surprising to find that the actual reduction in solid matters was very much less than during the previous period of one filling a day. One explanation of this difference may be that during the earlier period the larger volume of wastes aërated, in proportion to sludge, provided a larger quantity of matter easily attacked by bacteria, whereas during the second period the sludge had already been worked over by them for a considerable time.

On one occasion, through an error, the air was turned on at full pressure, causing the violent agitation of the tank contents. This resulted in a marked disintegration of the sludge, after which settled samples from the aëration tank were decidedly muddy in appearance. The fine suspended matter into which the sludge had been broken up did not coagulate on further normal aëration.

Period of Operation on One Filling per Day.

Beginning March 6th, the aëration tank was put into operation again on a schedule of one filling each working day, the contents of the tank being heated by the introduction of live steam to a temperature of about 70 deg. Fahr. During this period the total quantity of sludge increased over 100 per cent, although the average quantity present per filling was but 24·3 per cent of the influent. The sludge became darker in colour and more flocculent. When freshly collected, it had only a slight earthy odour, but on standing overnight developed a disagreeable fishy smell.

Period of Operation with Increased Proportion of Sludge.

The period from April 3rd to May 1st was marked by an increase in the proportion of sludge to the quantity of wastes treated. The tank was operated on the basis of one filling each working day, and the wastes were artificially heated to approximately 70 deg. Fahr. As there was only a slight accumulation of sludge during the period, the quantity of influent was reduced to increase the proportion of the sludge, which averaged 28·7 per cent of the influent treated. With this increase in proportion of sludge, there was a decrease in the turbidity of the effluent, which had previously been very marked. Most of the samples, which were decidedly turbid, passed the putrescibility tests, indicating that stability may precede clarification under some circumstances. In spite of the nett increase in the volume of sludge in the tank during this period, the total volume of sludge produced per 1,000,000 gallons of wastes treated, from the beginning of the test to May 1st, was reduced 23 per cent below the corresponding quantity as of April 3rd. There was an apparent loss of 93·8 per cent of total solids and 89·7 per cent of organic matter.

Period of Operation on One Filling per Day.

The period from May 1st to May 29th differed from the preceding one mainly because artificial heating of the contents of the aëration tank was discontinued. The tank was filled six times a week, each filling being aërated for about twenty-one hours, except that the Saturday filling received about forty-five hours' aëration. As in previous periods, the proportion of activated sludge was slightly greater than in the preceding period. The volume of sludge present decreased until May 15th, and then increased again, the nett increase for the period being 3,150 gallons per 1,000,000 gallons of wastes treated. The total volume of sludge produced per 1,000,000 gallons of wastes treated to June 2nd was 3,910 gallons, a

* Paper read before the American Society of Municipal Improvement

decrease of 6·2 per cent. from that produced to May 1st.

The loss of total solids during this period amounted to 50·1 per cent. and of organic matter to 88·0 per cent.

PERIOD OF OPERATION ON TWO FILLINGS A DAY.

From May 22nd to June 21st the aeration tank was fed twice daily, thus reducing the period of aeration slightly over 50 per cent.

Beginning June 12th the effluent became decidedly muddy in appearance due to the presence of much finely divided suspended matter, which did not settle out in the period of sedimentation afforded. It was evident that the sludge was becoming disintegrated, but this condition could not have been due to violent agitation, since the air had been applied at only a moderate pressure. The proportion of sludge was much greater than during the preceding period, though not unusually large, being only about 30 per cent. of the total volume aerated.

On June 13th the tap water was still muddy in appearance, and aeration was continued for an additional nine hours with no improvement in the appearance of the effluent. In fact there was no improvement in the effluent throughout this period, although air was applied at widely differing rates and different periods of aeration were afforded. The effluent for the week ending June 19th showed 200 parts per 1,000,000 of suspended solids.

Although no sludge had been removed from the aëration tank since the beginning of the tests on December 29th, sufficient sludge had not accumulated during the six months to afford as large a proportion of activated sludge as was desired for the tests. It is probable that the long-continued aeration of the sludge had produced a humus-like substance, which became so great in quantity that it came to serve in part mechanically as the body of the sludge and was drawn off as settled solids of non-settling matter.

The fine suspended matter drawn off was comparatively stable, like humus, and the sludge was in a highly activated condition. In fact, it may be said that the unsatisfactory appearance of the effluent was due to over-activation of the sludge. The only remedy apparent is to be to remove a portion of the old sludge and so come to building up a larger proportion of fresh sludge.

Accordingly, on June 21st, nearly half of the sludge was removed and the aeration tank continued in operation on two fillings a day. The effluent from the first filling, after reducing the proportion of sludge, showed no appreciable improvement in clarification, but the effluent from the next filling showed a marked improvement, and after two days the effluent became nearly normal, the suspended matter having been reduced from about 200 p.p.m. on June 21st to about 50 p.p.m. on June 24th. The volume of sludge in the aeration tank increased nearly 40 per cent in eight fillings.

There was a net loss of 13·8 per cent in the volume of sludge in the tank during the period, but this was not wholly due to bacterial action, as a large quantity of fine disintegrated sludge was carried away in the effluent, as previously mentioned. The volume of sludge produced to June 21st was 2,770 gallons per 1,000,000 gallons of wastes treated, a reduction of 29·2 per cent from that on June 2nd.

The loss in total solids during this period amounted to 38·9 per cent and in organic matter to 93·6 per cent. Computation showed that the loss in total solids from March 6th to June 21st amounted to 82 per cent, and that in organic matter to 80·9 per cent. The loss in fats during this period, of somewhat over three months, amounted to 98 per cent.

PERIOD OF OPERATION ON TWO FILLINGS A DAY, WITH REMOVAL OF SLUDGE.

From June 21st to July 17th the test was continued on two fillings of the tank each day. On June 21st half of the sludge was removed, and a rapid accumulation of sludge followed. On July 5th another removal of half the sludge was made, and again on July 17th.

After removing half of the sludge from the aeration tank on June 21st, the effluent began to lose its muddy appearance, and on June 24th it had merely a distinct turbidity, with suspended matter equivalent to about 50 parts per 1,000,000. On June 28th the effluent became decidedly turbid, and the stability decreased materially. The second day after the removal of about half of the sludge on July 5th the effluent was exceedingly turbid, and contained only about 18 parts per 1,000,000 of suspended matter. It was perfectly stable.

The total volume of sludge produced during the period was equivalent to nearly 10,000 gallons per 1,000,000 gallons of wastes treated, nearly as much as for the first period. By removing the sludge frequently, time was not allowed for the bacterial action, which would have caused liquefaction and gasification. The volume of sludge produced to July 17th was 4,630 gallons per 1,000,000 gallons of wastes treated, an increase of 67 per cent over that produced prior to June 21st. The total solids removed from the wastes, but unaccounted for in the sludge, amounted to 57·5 per cent, and the organic matter to 97·2 per cent. There was a similar loss in fats, amounting to 54·1 per cent.

SLUDGE DIGESTION.

One of the most significant facts developed by this test is the disappearance of material removed from the wastes, and which at first thought would be expected to be present in the sludge.

It is a law of chemistry that when chemical action takes place the sum of the resulting substances is equal in weight to the sum of the substances entering into the reaction. Matter is indestructible. It follows, therefore, that the amount of solids disappearing must have passed into the atmosphere as gas. It may fairly be assumed that bacterial action was largely responsible for this loss. The liquefaction and gasification of sewage solids by bacteria is called bacterial digestion. During the test from December 29th to July 17th there was lost, through such digestion, 78·1 per cent of the organic matter removed from the wastes.

Bacterial digestion of organic matter is generally accompanied by an increase in mineral matter. In this case there appears to have been an actual decrease in mineral matter of 77·8 per cent. It is hardly conceivable that bacteria could have digested mineral matter. It is quite possible, however, for mineral matter to be so changed in composition, as a result of bacterial action, that the fixed matter remaining after ignition will have a different weight. For example calcium nitrate may be precipitated by carbon dioxide resulting from bacterial action, in the form of calcium carbonate, which, after ignition, would be weighed as calcium oxide with an apparent loss of about 56 per cent.

It seems quite certain that chemical action taking place during aeration explains the apparent loss in mineral matter. With such a variety of chemicals as is found in these wastes, it is to be expected that a variety of chemical reactions will take place on aëration. The marked avidity of the wastes for oxygen shows that chemical oxidation takes place on aeration.

QUANTITY OF SLUDGE PRODUCED.

The quantity of sludge which will be produced by the activated sludge process will depend upon the method of operation and the extent to which bacterial digestion of the sludge is carried. The results of these tests show that it is possible to activate the sludge to the point where there is practically no increase in the volume of sludge. To do this undoubtedly requires the expenditure of an amount of air greatly in excess of that required to produce a satisfactory effluent.

On the other hand, it does not appear to be possible to accomplish satisfactory purification of the wastes by this process without considerable digestion of sludge. With the most economical use of air, the volume of sludge to be disposed of will probably not exceed 10,000 gallons per 1,000,000 gallons of wastes treated.

During the period of sludge accumulation from December 29th to February 7th, there was produced a total of about 11,000 gallons of sludge per 1,000,000 gallons of wastes treated. During the period of sludge activation from February 7th to March 6th, this volume was reduced 62 per cent. After operating on one filling a day until May 23rd, the total volume of sludge produced was less than 3,000 gallons per 1,000,000 gallons of wastes treated. After starting on the schedule of two fillings a day the sludge became more voluminous, but, owing to over-activation, the volume of sludge decreased until June 21st, when the total volume of sludge produced fell to 2,770 gallons per 1,000,000 gallons of wastes treated up to that time. During the period from June 21st to July 17th, with occasional removal of sludge from the aeration tank, the sludge product on was nearly 10,000 gallons per 1,000,000 gallons of wastes treated. During the latter

part of this period the sludge was not kept as well activated as is desirable. With better activation of the sludge the volume would be reduced.

DIGESTION OF FATS.

It is particularly interesting to note the digestion of fats which occurred during this test. From the beginning until June 17th the quantity of fats which disappeared and were apparently digested by bacterial action amounted to 88·7 per cent of the quantity removed from the influent. This quantity was intrinsically large, amounting to 5,792 lb. per 1,000,000 gallons, equivalent to nearly 91 parts per 1,000,000. In other methods applied to the treatment of municipal sewage it has been found that the digestion of fats was a relatively slow process, and quite the reverse of the action in this test.

INCREASING VOLUME OF SLUDGE BY ITS PARTIAL REMOVAL.

It appears to be essential to efficient clarification, and probably to the production of a stable effluent, to remove the sludge at relatively frequent intervals. If this is not done the sludge becomes over-activated, resulting in disintegration, a turbid effluent and a reduction in the volume of sludge. By withdrawing a portion of the sludge at regular and frequent intervals it is to be expected that a larger quantity of sludge will be produced, and that it will be of such a character as to perform its function more efficiently than if allowed to remain too long in service.

It is conceivable that under some conditions over-activation of the sludge may be warranted as a means of reducing its volume and the difficulty of its ultimate disposal. This would be where the quantity produced or the ingredients of fertilising value are too small to warrant an attempt to convert the sludge into marketable fertiliser.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Why is it that there appears to be a prejudice against concrete roads in this country? Is it because of their initial cost as compared with cheaper and less substantial forms of construction, is it on account of the want of success that has, unfortunately, attended some of the work already done, or is it because road engineers prefer to "suffer the ills they have rather than to fly to others they know not of"?

* * * *

Will not the enlistment of roadmen for service in France, under the scheme recently outlined by Mr. Maybury, still further deplete the labour which is so urgently required on the roads in this country? Why cannot the Government make up their minds to employ some of the interned Germans, or the prisoners of war in our hands, to assist in this work, and thus follow the example of our enemies, who have no scruples as to the manner in which they make use of their prisoners? If it is a question of guarding these men, are there not a large number of patriotic citizens who, if suitably armed, would gladly undertake such a duty?

* * * *

Is not the question of food economy during the war one that depends largely upon the individual citizen rather than Government edicts? Would not the individual be more likely to practise economy if he were set the example by the Members of the Cabinet and Members of Parliament themselves? Is there not an adage that "Monkeys follow their masters," and is it not evident that if an individual practises what he preaches he is more likely to obtain followers?

* * * *

Is it not to be hoped that the conference as to public safety, which has been organised by the London General Omnibus Company, and which will be held to-day (Friday), will result in more practical suggestions for the safeguarding of pedestrians who are obliged to be in the streets during the dark nights? Could not the police regulations as to pedestrians keeping "to the right" be altered "to the left," which is safer for obvious reasons? Could not people also be warned to take more advantage of the refuges and subways which already exist, and could not more of these safeguards be provided?

* * * *

Are not my thanks due to Mr. Edward Walker, of Stretford, for having replied in the last issue of The Surveyor to the question I asked some time ago as to the derivation of the word "scavenger"? Will he be equally obliging and give me the correct derivation of a "navvy"? Was it merely that the labourers, who used to be employed in digging canals for navigation, had that name given to them, or does that appear to be too far fetched?

* * * *

In what part of the Midlands was it that an experiment was tried of making roads with bitumen and waste pieces of leather which were ground up and desiccated before the bitumen was applied? In the absence of information, may we not conclude that the experiment was not very successful? Why is it we so seldom hear of failures and only of successes? Would it not be better if we could hear of both?

* * * *

Did not the surveyor of Tring come off with flying colours by his dignified reply to his council when they had haggled over a question of giving him 10s. or 5s. a week for services which were entirely outside his regular duties? When *will* councils learn to be dignified?

* * * *

Is it not somewhat remarkable that the *Municipal Officer*, which is the official organ of the National Association of Local Government Officers, should this month have an article containing some scathing criticisms of the recent annual meeting of the National Council of that body? What was so wrong with this gathering that the writer of the article in question should see fit to describe it as a nightmare, and at the same time accuse the delegates of "narrowness of outlook," "selfishness," and "withering funk"? And what is wrong with the association?

* * * *

Is it not a pity that Cromwell-road, one of the handsomest streets in the Metropolis, leads nowhere and carries very little traffic? Would it not be an excellent thing if this road could be connected up with the new Great West Road out of London, which is in course of construction, and thus make a useful as well as ornamental boulevard, worthy of England's capital city?

ASHTON-UNDER-LYNE, STALYBRIDGE AND DUKINFIELD (DISTRICT) WATERWORKS.

The population of the areas served by the above-named authority is estimated at 148,083, and in his report the engineer, Mr. Fred J. Dixon, M.Inst.C.E., F.G.S., states that the total volume of water delivered from the various sources of supply into consumption, including compensation, during last year, was 1,672,174,368 gallons. The consumption per head per day for all purposes, including compensation water, was 33·45 gallons, and with the exclusion of compensation water 22·24 gallons, against 20·77 gallons for the year 1914.

Water is obtained by the board from three gathering grounds in the Pennine Chain, some 4 or 5 miles distant from Ashton-under-Lyne.

The number of meter supplies now stands at 902, a decrease of thirty-three as compared with the previous year.

At the Ashway Gap and Brushes pressure filters installations the total amount of water dealt with during the twelve months under review represented a consumption of 1,127,785,000 gallons of water, a decrease of 10,402,000 gallons below the figures for the year 1914. The total cost per 1,000,000 gallons works out to 6s. 7d., against 6s. 11d. for the previous year—a considerable reduction when the cost of raw materials and the scarcity of labour is taken into consideration.

The report mentions that, as a result of eleven analyses made by Prof. Delèpine, on only one occasion was bacillus coli communis found in 100 c.c. of the treated water.

Proposed Arterial Roads Schemes for the Provinces.—At a conference of manufacturers and merchants of South-east Lancashire, held in the Memorial Hall, Manchester, last week, a resolution was passed appealing to the Government through the Local Government Board to convene district conferences, similar to those already formed for Greater London, to consider the question of improved arterial road construction in the great industrial areas.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Aberdeen T.C.—It is proposed to carry out repairs to the Wallace-ton suspension bridge over the Dee, at an estimated cost of £600.

HOUSING AND TOWN PLANNING.

Arklow U.D.C.—It is proposed to carry out another housing scheme.

Glasgow T.C.—The city council met in committee on Monday to discuss the housing question. The meeting was the outcome of a letter which the town clerk (Sir John Lindsay) submitted to the corporation suggesting that a commission of gentlemen known to be capable of dealing with the housing of the working and poorer classes and with city improvement should be appointed to go into the whole subject. The corporation, after discussion, approved of the appointment of a committee, who will be empowered to obtain such advice as they might think necessary to enable them to submit to the corporation a report on the housing question in its various aspects.

Worcester T.C.—With a view to the ultimate adoption of a town planning scheme for the Astwood road and Bilford-lane area, it has been agreed that, whenever any part of the land is sold, the frontage to a certain depth shall be forthwith added to the road in front thereof, and that the council shall pay for the land so added at the rate of 1s. per yard.

PARKS AND OPEN SPACES.

Worcester T.C.—The city council have adopted a recommendation of the Streets Committee to lay out the surplus land on the north side of Hound's-lane as a playground for the children of the neighbourhood, at an estimated cost of £275, and to invite the Playgrounds Association to erect small seats, swings, and see-saws upon the southern portion for the use of little children only.

MOTOR TRANSPORT.

Stoke-on-Trent T.C.—The tender of Messrs. J. Morris & Sons, Manchester, has been accepted for the supply of a four-cylinder petrol motor fire engine of 500 gallons capacity per minute, with equipment.

REFUSE COLLECTION AND DISPOSAL.

Doncaster R.D.C.—A sub-committee of the Sanitary Committee have been appointed to ascertain the cost of a site for the erection of machines for the disintegration of scavenging refuse, as well as the terms upon which electric energy can be supplied, and the price of the necessary machinery.

ROADS AND MATERIALS.

Abercarn U.D.C.—The surveyor, Mr. John Williams, and two members of the council, have been deputed to wait upon the Local Government Board to submit for approval a scheme, estimated to cost £10,023, for an improvement at Kendon, including the construction of a 36-ft. road.

Bucks C.C.—The council have supplied four 10-ton steam rollers for immediate use by the Road Board, on behalf of the War Office in France, and the War Office have undertaken to supply new ones to take their place.

Bury T.C.—The Paving Committee have agreed to repave part of Silver-street.

Doncaster R.D.C.—The council have agreed to take over the private roads in Askern New Village if the owners make up the surface of the streets to the satisfaction of the surveyor.

Greenwich B.C.—It has been agreed to carry out repairs to Prince-street, Deptford, at an estimated cost of £357.

Godalming T.C.—The chairman of the Highways Committee and the borough surveyor, Mr. Alan Bromly, are negotiating for a further width of road in connection with the Farncombe-street widening scheme.

Grimsby R.D.C.—Application is being made to the Local Government Board for authority to put the Private Street Works Act into force with a view to the construction of a number of streets.

Ham U.D.C.—The council have adopted a recommendation of the Finance Committee that the surveyor should be authorised to spend £10 in any month to repair any path that he thought required attention.

Honiton R.D.C.—In the course of a discussion on the roads, the surveyor, Mr. W. North, said he was quite prepared—if the council were of the opinion that he would be of more use in France than to them—to go. The county surveyor, however, had pointed out that he would probably be of more use at home.' With regard to the maintenance of the roads, it had been said those in France were most important. It was essential, however, that the main trunk roads and the secondary trunk roads at home should be kept in good condition. The district roads would have to go. The council agreed to the suggestion of the surveyor to allow the district roads to go. A resolution was also passed that the Government be asked to allow the use of German prisoners on the main roads.

Horncastle R.D.C.—The question of tar-spraying the roads during next summer was considered, and it was resolved that, owing to the prospective shortage of labour, no tar-spraying should be done on either the district or main roads, and that the county council should be informed accordingly.

Kildare C.C.—The county surveyor, Mr. R. H. Hall, has prepared for presentation to the Road Board an estimate for steam rolling about 6 miles of road to the Curragh Camp.

Kingsbridge R.D.C.—It has been agreed to invite tenders for taking off a dangerous corner and widening the road by 18 ft. near Aveton Gifford Rectory.

Nairn C.C.—In consequence of the damage caused to the roads by War Office traffic, the council are asking for grants of money from the Government and the Road Board.

Newmill U.D.C.—Plans have been approved for the repair of the road from Scholes to Valley Mill.

Orsett R.D.C.—The surveyor, Mr. F. T. Johnson, reported that the repairs to the road between Vange and Fobbing, which had been damaged by heavy traffic, would cost approximately £250, and he was authorised to do his best to secure the necessary materials for the work.

Pickering R.D.C.—The surveyor, Mr. S. Russell, reported upon a number of roads damaged by extraordinary traffic, and the clerk stated that the Road Board recommended the council to apply to those responsible for the damage. He added that the proper procedure would be to put the roads into a state of good repair and then claim any sum which might exceed the amount which would have been incurred under normal conditions. The surveyor explained that the farmers declined to send teams to lead the stone. They objected to 7s. per day, and wanted 10s. The surveyor was instructed to carry out the repairs where possible.

Rochdale T.C.—Consideration is being given to the scheme for the widening of Milnrow-road from Walker-street to Moss-street, when the Lancashire and Yorkshire Railway Company exercise the powers conferred by their Act of 1901. The proposals include the raising of the bridges in Fishwick-street and the improvement of a dangerous curve. The approximate estimate of cost to the town council is £12,000.

Salisbury R.D.C.—Letters have passed between Mr. Hamilton Fulton and the county surveyor in regard to the danger to fish in streams by the roadside when roads were tarred, and suggesting that a harmless preparation should be used. Mr. Greenwood said there was no doubt that for the last two years hundreds of trout had been seen floating dead in the rivers. Experts had traced the cause to tar-spraying, and serious loss had been the result both from the financial and the sporting point of view. Everything that could be done in the way of using a preparation

innocuous to fish should certainly be done. The chairman said he thought the surveyor would do his best in that direction.

Tisbury R.D.C.—It has been resolved to purchase a tar-spraying machine for £90.

SEWERAGE AND SEWAGE DISPOSAL.

Banbury T.C.—With reference to the Local Government Board's refusal to sanction the proposed sewage disposal scheme, it is intimated that the Thames Conservancy have decided to urge that part of the work should be carried out to prevent further pollution.

Hants C.C.—It has been agreed to execute surface-water drainage works at Hursley, at an estimated cost of £1,200.

WATER, GAS, AND ELECTRICITY.

Ballycastle R.D.C. A scheme has been sanctioned for an improved water supply for Ballintoy.

Chester-le-Street R.D.C.—The council have asked for a report on the best means of improving the Portobello water supply.

Edinburgh T.C.—A report has been submitted to the Cleansing and Lighting Committee with regard to automatic gas lighting experiments, and it has been referred to the chairman and the inspector of lighting to consider the question of further extensions.

Hammersmith B.C.—It is proposed to extend the electricity mains in the Starch Green district, at an estimated cost of £683.

Hull T.C.—Sanction is being sought for a loan for the provision of a water-cooling system at the electricity works.

Port Glasgow T.C.—The town council will make application in the ensuing session of Parliament for authority to carry out a scheme for the extension of the waterworks.

Rawmarsh U.D.C.—The council are taking up a loan of £1,000 for the requirements of the gasworks.

Walthamstow U.D.C.—It has been agreed that from the December quarter the price of electricity be increased 10 per cent for lighting and 5 per cent for heating and power to all consumers except those who had entered into long-period contracts.

Worcester T.C.—The city council have accepted the tender of Messrs. Fisher, Humphries & Co., Limited, of Atlas Works, Pershore, for overhauling an engine and pumps at the waterworks at a cost of £386. Mr. Sharpe stated that the engine and pump had been working continuously for fourteen years.

MISCELLANEOUS.

Hoylake and West Kirby U.D.C.—The engineer and surveyor, Mr. R. W. Fraser, has prepared a plan for a concrete wall to prevent the encroachment of drifting sand at the shore end of King's Gap, Hoylake, and the council have asked him to give an estimate of the cost of the proposed work.

Kingsbridge R.D.C. — A committee has been appointed to inspect the sea wall at Hope Cove, which was seriously damaged in the recent gale.

Shrewsbury T.C.—It is proposed to carry out an extension of the cemetery, at an estimated cost of £2,200.

Wallasey T.C.—It was reported that the nett balance from the tramway undertaking last year was £8,460.

FOR OTHER ADVERTISEMENTS
See End of Paper.

CHERTSEY URBAN DISTRICT COUNCIL.

A Temporary Engine Driver required (ineligible for military service) for the duration of the War, to take charge of the Addlestone Sewerage Pumping Plant (Messrs. Davey Paxman Steam Pumping Plant), &c.

Wages (with 5s. War Bonus included), £2 per week.

Applications, in candidate's own handwriting, stating age, and giving full particulars as to experience, and accompanied by copies of three testimonials, to be sent to the undersigned not later than the 9th of December next, endorsed "Engine Driver."

Canvassing will disqualify.

F. W. GREIG,
Surveyor.

63,183

PERSONAL.

Mr. James Duncan, burgh surveyor of Ardrossan, has been appointed water manager for the burgh, in place of the late Mr. Anderson. He will hold both offices

Mr. A. T. Walmisley, M.INST.C.E., engineer to the Dover Harbour Board, will preside at the distribution of certificates to the students of the Crystal Palace School of Practical Engineering on Wednesday, December 20th, at 3 p.m.

Mr. William Alexander, burgh surveyor of Rosehearty, has been provisionally appointed temporary road surveyor to the Deer District Committee of the Aberdeen County Council, at a salary of £200 a year, including travelling expenses. The Rosehearty Town Council have agreed to grant Mr. Alexander the necessary liberty on condition that he looks after his own duties at Rosehearty.

Mr. William A. Clegg, surveyor and sanitary inspector to the Dorking Urban District Council, whose appointment to Littlehampton was reported in our issue of last week, served his articles with Mr. S. S. Platt, M.INST.C.E., borough engineer of Rochdale. He has

Mr. William A. Clegg,
Littlehampton's New Surveyor.

held appointments at Kettering and Boxhill-on-Sea, and has occupied his present position since September, 1910. Mr Clegg has had an extensive and practical experience in road construction, drainage and sea defence works. He is a member of the Institution of Municipal and County Engineers.

OBITUARY.

Mr. Archibald Wilson, county road surveyor of Dumbartonshire from 1868 to 1915, died on Saturday last, we regret to state. He studied civil engineering and road surveying under his uncle, the then road surveyor of the county, whom he succeeded. He was about sixty-nine years of age.

We regret to report the death, in action, on October 7th, of Sergeant H. W. Lovelock, 7th London Regiment. Sergeant Lovelock was formerly chief assistant to Mr. T. C. Barralet, surveyor to the Godstone Rural District Council, and enlisted soon after the outbreak of the war, serving in numerous actions and winning the Military Medal for distinguished bravery. Besides being an all-round athlete of fine physique, he was a most promising member of the profession, a medallist in mechanical engineering and building construction, and a member of the Institution of Municipal Engineers and the Royal Sanitary Institute. He fell in an attack at the early age of twenty-five. The Godstone Rural District Council have placed on record their high appreciation of his abilities and patriotism.

Street Lighting Economies.—It is estimated that the cost of public lighting in the Hendon Urban District for the year will show a reduction of about £2,000, which is equal to a rate of 1½d. in the pound. —Harrow Council have saved £520 during the past six months through not lighting the public street lamps.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRY HELD.

Belfast T.C. (November 21st. Mr. P. C. Cowan).—£16,500 and £1,000 for the purposes of (1) completing the scheme under the Housing of the Working Classes Acts, authorised by the Belfast Improvement Order, 1910, and (2) extending the city cemetery at Glenalina.

The solicitor to the city council, Mr. John McCormack, stated, with respect to the proposed loan for the cemetery, that the corporation had been authorised to borrow £22,000 in order to acquire and lay out the grounds at Glenalina. Up to the present time the corporation had expended £12,390. There was a considerable amount of the loan unexhausted, and the reason for the application was the Treasury restrictions in regard to expenditure during the war. The corporation thought the Local Government Board ought to be apprised of the fact that they wanted to spend the £1,000. The money was urgently required in order to provide accommodation for burials. The inspector said he understood there was another important circumstance which would enable them to obtain money without going into the outer market. The solicitor said the city accountant had made ample provision in regard to that matter. The corporation was authorised under the Act of 1913 to utilise the Consolidated Loans Fund. The city surveyor, Mr. H. A. Cutler, M.INST.C.E., was examined in regard to the application for the loan to complete the scheme under the Housing of the Working Classes Acts. The money, he said, would be expended largely on the streets in the areas concerned.

APPLICATION FOR LOAN.

Walthamstow U.D.C.—£13,140 for electricity purposes.

LOAN SANCTIONED.

Dundee T.C.—£27,000 for electrical extensions.

SOME RECENT PUBLICATIONS.*

ARCHITECTURAL BUILDING CONSTRUCTION. Vol. I. By W. R. Jaggard, F.R.I.B.A., and F. E. Drury. Price 6s. nett. Cambridge: The University Press.

This is the first volume of a work which is intended to cover three volumes before it is completed. Some surprise may be expressed that the authors should have undertaken such a work when there are already so many books on building construction available. If no excuse be needed, however, for yet another work on the subject, it is to be found in the present case by the clear and interesting way in which the matter is presented to the reader. Hitherto building construction has been learnt by the study and working out of a number of isolated examples, which have no relation whatever to each other, and thus the knowledge obtained cannot be applied to the actual design of a building even of the smallest dimensions until a very much later date. In this book, however, the various items can be connected in one or two definite buildings, the principle being to teach from the structure itself rather than by isolated examples selected on account of their suitability. A general description of the buildings, a cottage and a workshop, is contained in an introductory chapter, and contract drawings are given on loose sheets in a pocket to the cover as a definite study in the science and art of building. The book has much to commend it, and students will be grateful to the authors for having added a new interest to their work from its earliest stages.

ARITHMETIC FOR ENGINEERS. By C. B. Clapham, B.SC.ENG. Price 5s. 6d. nett. London: Chapman & Hall, Limited.

As appears from the subtitle of this very useful work, it is not limited in scope to pure arithmetic, but includes, in addition, simple algebra, mensuration, logarithms, graphs, and the slide rule. It is thus a complete manual of elementary technical mathematics. Its great value lies in the fact that it not only deals with each subject in such detail as to render it clear to the reader as regards theory, but that it goes on to provide a sufficient amount of engineering application. Moreover, every principle is illustrated by fully worked examples, a feature that will be specially appreciated by those who use the work for private study, a purpose for which it is admirably adapted in every way. The matter is freely interspersed with examples to be worked by the student, the answers to which will be found at the end of the book, together with a full index. The book should attain considerable popularity with class teachers, tutors, and private students alike.

ELEMENTARY SANITARY ENGINEERING. By G. Bransby Williams, M.INST.C.E. Price Rs.5. Calcutta: Thacker, Spink & Co.

This little book has been written specially for Indian sanitary inspectors, to whom it should prove very useful. Some two years ago a local service of municipal sanitary inspectors was instituted by the Government of the Bengal Presidency, and although candidates for these appointments have to undergo a short course of training, it is evident that such instruction as is given must be of an elementary character. Indian cities and towns afford a splendid field of work for well-trained sanitary officers, and in preparing this text-book Mr. Williams has performed an important public service. The first chapter is preliminary, and is followed by chapters on drawing and mensuration, surveying and levelling, building construction, drainage and sewerage works, sewage disposal, and waterworks. The several subjects are treated quite generally, and the book will be read with interest by English inspectors.

TRANSACTIONS OF THE INSTITUTION OF WATER ENGINEERS, 1915 (Vol. XX.). London: The St. Bride's Press, Limited.

The papers and discussions reproduced in this volume comprise those on "The Effect of Springs upon Water Levels in the Chalk of Eastern Surrey," by Mr. Henry Dewey, F.G.S., "Hydro-geological Conditions at Newbald, East Yorkshire," by Mr. Percy Griffith, M.INST.C.E.; and "Notes on the Definition of the Term 'Domestic Purposes' in General and Private Water Acts," by Messrs. A. B. E. Blackburn and Percy Griffith. In addition there are included a summary of contents and a subject index of Volumes i. to xx.

THE RAILWAY SWINDLE. By Henry Murray. Price 2s. 6d. nett. London: Grant Richards, Limited.

The author of this book attempts to justify his description of British railways as "the most colossal and impudent swindle in human history—a swindle which has Peers of the Realm among its perpetrators, Cabinet Ministers among its tools, and the entire British community for its dupes and victims." This is a sufficiently strong indictment, and both defenders of the system and advocates of reform will be interested to judge whether the author succeeds in sustaining it.

Messrs. Crosby Lockwood & Son announce that, consequent on the recent advance in the cost of materials and labour, also the still further expansion of the literary contents of "The Engineers' Year Book," the proprietors are compelled to make the price of the forthcoming 1917 edition 20s. nett. This old-established and indispensable annual, now in its twenty-fourth year of publication, more than justifies its position in the front rank of professional year-books. Its dependability and usefulness to the up-to-date engineer, in whatever branch of the profession he may be engaged, is proverbial.

Vegetable Growing in Public Parks.—A proposal is before the Corporation of South Shields for utilising the public parks as vegetable gardens.

Motor Road Brooms. At the last meeting of Lewisham Borough Council a member asked that consideration should be given by the Works Committee to the purchase of one or two motor road brooms.

City of London Refuse.—The refuse removed from the City of London in 1915 consisted of 20,618 cart-loads of street sweepings and slops, and 58,441 loads of house and trade refuse, a total of 79,059 loads. The total for the year 1914 was 75,960. The use of the destructor was discontinued in September, 1905, since which date all refuse has been removed by barge from Lett's Wharf to the corporation land on Hornchurch Marshes, where it is dealt with. The horse manure collected from the street orderly bins is not included in the above, but is dealt with by a contractor, who sells it to market gardeners and others.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

MUNICIPAL SCHEMES AFTER THE WAR.

CAMBERWELL B.C. The borough engineer, Mr. W. Oxtoby, M.INST.C.E., has submitted to a Special Committee a number of projected schemes, and these having been considered, a resolution was adopted expressing the opinion that it was premature to consider what works can be put in hand after the war until the state of national and local finances could be more definitely ascertained. The committee aver that they are strengthened in this view by the fact that it was very definitely stated at a conference of manufacturers that there would be more than sufficient work in ordinary commercial enterprises for every available man after the war.

CHESHIRE C.C.—It is proposed to reconstruct the Ellesmere Port road, at an estimated cost of £10,000; Stockport to Macclesfield road, at an estimated cost of £10,000; Woodhead-road, at an estimated cost of £5,500; and Warrington-road, £2,000. Building and alteration schemes in connection with asylums are also proposed, including a new well and water supply. The building of many new schools is also contemplated.

HULL T.C.—It was stated at a meeting of the Health Committee that the works under that department to be underaken after the war included the large housing scheme involving the demolition of New George-street, and a suburban housing scheme. The Housing Sub-Committee give no estimates, but state that the officials concerned are authorised to give any further particulars that may be required by the Parliamentary Committee.

NEWTON ABBOT U.D.C.—It has been agreed to include the following schemes in the works projected after the war: Workmen's dwellings, public slaughter-house, park lodge and public convenience, extension of concreting the bed of the River Lemon.

ST. COLUMB R.D.C.—The council propose to execute the following schemes: Drainage of Trevone Village, sewerage of Crantock Village, erection of six working-class dwellings in the parish of St. Columb Major, and widening and improving the road from Indian Queens to Quintrel Downs in order that the road may be declared a main road.

SURREY C.C.—Schemes are proposed costing in the aggregate £382,921, including police stations and cottages, balance of surfacing work, main road kerbing, bridges, tuberculosis hospital and sanatorium, and schools.

Timber, Plywood, and Woodwork. In next week's issue there will appear a page advertisement which will give various particulars of timber, plywood, and woodwork which Messrs. C. Jennings & Co. have for sale. The page will be found useful for reference by all who make use of such goods. The firm's head office is at Pennywell-road, Bristol, but they have branches at Leicester, Porthcawl, and stocks warehoused at Swansea, Hull, Pembroke Dock, Neyland, Newcastle, Manchester, Liverpool, and elsewhere.

Merthyr's Difficulty.—The Pontypridd and Rhondda Joint Water Board applied to the Merthyr Corporation some time ago inquiring whether, in the event of their requiring a temporary supply of water before the Taf Fechan reservoir was completed, the corporation could supply it, and at what price. The Taf Fechan Reservoir Committee have come to the conclusion that at present no supply can be given, as the Merthyr Corporation has been prevented from constructing the new pipe line, not having received sanction for the raising of a loan for the purpose.

The Condition of Wiltshire Roads.—The chairman of the Roads Committee of the Wilts County Council, Lord Roundway, stated at the meeting of the council recently that large lengths of roads used by the military had been made up. After the making up of such large lengths of road, it would be natural to expect a very distinct improvement should be shown with regard to the county roads. While admitting that the condition of some of the roads was not as good as before the war, the county surveyor was of opinion that the greater length of road was infinitely better than it was at that time. To add to their difficulties, the sources from which they had hitherto drawn their road material had been very considerably reduced, because the War Office had commandeered two of the most important.

WAR-TIME USE OF VACANT LAND IN TOWNS.

THE EXAMPLE OF BOGNOR.

The publication in our correspondence columns of last week of the letter in which Mr. Oswald A. Bridges drew attention to the importance of local authorities putting into cultivation all available land for the growing of foodstuffs has resulted in his receiving a large number of communications from brother officials who are anxious to have further particulars of what has been accomplished in this connection at Bognor. Information is sought on various points, and this we are pleased to announce will be given in an article which Mr. J. Jupp, the clerk to the district council, will contribute to our next issue. The combined efforts of Mr. Bridges and Mr. Jupp have been instrumental in persuading the owners of undeveloped building estates at Bognor to hand over their land rent free to the local authority, who let out the ground in 10-rod plots at a charge of 6d. per rod, and the consequence is that nearly the whole of the land in question is now in cultivation by the allotment holders.

A GOVERNMENT SCHEME.

In connection with the foregoing, it is of interest to notice that in the House of Lords on Wednesday the Earl of Crawford said it was hoped to stimulate local authorities to extend allotments as much as possible, and that it was proposed to issue during the course of the next few days orders under the Defence of the Realm Act, which would make the acquisition of land for the purpose of small allotments and market gardens more easy. With a view to increasing this source of food supply it was proposed to empower the Board of Agriculture, acting through the existing allotments authorities, to enter on land which was now unoccupied—that was, land which was not paying rates, waste land, often enough in the form of building land awaiting development. Secondly, it was proposed that with regard to land already occupied the local authority should have the same rights, where consent was given for the use of the land by the owner and occupier. Finally, subject to careful safeguards by the Board of Agriculture, the production of food of this particular character was so desirable that it was proposed to authorise the use of selected portions of common land for its production. He hoped that landowners and their tenants would, wherever it was desirable, surrender land convenient to villages and small towns.

NIGHTSOIL AND DRY REFUSE REMOVAL.

WEST BROMWICH FIGURES.

At the present time, says Mr. H. H. Spears, the chief sanitary inspector, in his annual report, only 2·4 per cent of the houses in the borough of West Bromwich are supplied with privies. The number of water-closets is 12,870.

There are approximately 9,950 ashbins, the contents of which are removed weekly, and 834 dry ashpits. The number of loads of dry refuse delivered to the destructor during the twelve months was 7,530, the tonnage being 8,048. This is a considerable reduction on the corresponding figures for the preceding year, which were 10,300 and 11,164 respectively; but for the greater part of the year, owing to the shortage of stokers at the destructor works, only one unit has been worked. On the other hand, a much larger quantity of refuse has been taken to tips, the number of loads being 5,787, and the estimated tonnage 6,185. In all, then, 13,317 loads, or 14,233 tons, have been collected. In 1914 the corresponding figures were 13,543 and 14,778.

The total quantity of refuse yielded per house was 0·96 load, or by weight 19·7 cwt.

The cost of removal of dry refuse, including team hire, wages, and maintenance and renewal of plant and charges for tips was £2,244. The cost of collection per load and per ton worked out at 3s. 9·9d. and 3s. 1·8d. respectively.

The cost of collecting refuse from a house with a privy was 18s. 8d., and from a house with a water-closet 3s. 1·1d.

War Bonuses.—Wealdstone Urban District Council have decided to pay war bonuses of 4s. 2d. a week to their employees, including their men on active service.

WOMEN AND ROAD WORK.

TWO CANDIDATES IN ABERCAVENNY RURAL.

The *Abergavenny Chronicle and Evening Post* reports an animated discussion which took place at the last meeting of the Abergavenny Rural District Council on the presentation by the surveyor of a report on the difficulty of getting road men. The surveyor said they were without men in several districts. Llanover, which was a hilly district, was suffering the most, and the roads there were going back very much.

In the course of the discussion the surveyor was asked if the effect of female labour made some time ago had materialised.

The surveyor said that a woman came to his office some time ago and seemed quite in earnest and willing to go on the road, and she also said that her sister-in-law was willing to do so. The two women came from Birmingham. He explained the class of work to them and pointed out that it was more difficult than working on town roads, and he said he could not put them on without the authority of the council, but he would bring the matter before them.

The chairman: I don't think the council would object if you could get good ones.

Mr John Lewis: It is like taking a wife. You don't know what they are like till you try them. (Laughter.) You have to take your chance. (Laughter.)

The chairman: It is a different thing to taking a wife. You could dismiss a woman from the roads if she did not suit. (Laughter.) You could try them if they are willing.

Mr. John Lewis: I have seen women doing work but men make a good deal of fuss of.

Mr. Bayman: I don't think it would be fair to put a woman on an open mountain road.

The chairman: I don't see any reason why we should not make a start. If you put one at Llanover even would be starting her on the toughest piece we have. It would be better to try them in the most sheltered situations first of all.

The surveyor: If you engage women on the roads I must insist that the members of the council do not interfere with them. They must be left absolutely to me. (Much laughter.)

The matter was left in the hands of the surveyor.

ANNUAL INSPECTION OF COMMERCIAL MOTORS.

The seventh annual inspection of commercial motors and examinations of drivers, organised by the Commercial Motor Users' Association with the object of encouraging drivers by means of money prizes and other awards, to take a personal interest in the driving and condition of their vehicles and to run them without accident, will take place in London during May, 1917, but the usual assembly, or parade, of vehicles will not be held, owing to the difficulty of sparing vehicles from service during the present period of stress.

Prizes will be awarded to drivers for results obtained in practical, written and oral examinations, coupled with inspection of their vehicles under running conditions. In this way it is hoped to carry on the educational work among drivers which has been one of the aims of the association since its formation in 1903. A new and advanced class of examination has been instituted, for which only the chief prize-winners in previous examinations are eligible. The inspecting engineer will visit each garage before the examinations, and his reports on these visits, together with the marks obtained by the drivers in the examinations, will be recorded by the committee, and the following awards based thereon:—

Class I. Championship Prizes (Practical and Written).—Steam section: 1st prize of £10, 2nd prize of £5; petrol section: 1st prize of £10, 2nd prize of £5; together with medals or badges and certificates.

Class II. Prizes (Written Examination).—1st prize of £5, 2nd prize of £3, 3rd prize of £2, and ten prizes of £1 each in each section—petrol, steam and electric.

Class II. Prizes (Oral Examination).—Amounting to about £50 in total value, subdivided into cash prizes of £2, £1, and 10s. each.

Full particulars and entry forms may be obtained from Mr Frederick G. Bristow, F.C.I.S., secretary, the Commercial Motor Users' Association (Inc.), 83 Pall Mall, London, S.W.

CESSATION OF BUILDING OPERATIONS.

CONTRACTORS' LIABILITY FOR ADDITIONAL EXPENDITURE.

In July last the Metropolitan Water Board were informed by their General Purposes Committee that the Ministry of Munitions of War had required the discontinuance of the work and the employment of workmen in the construction of the board's new offices in Rosebery-avenue.

The Ministry of Munitions have since informed the committee that they have no objection to the sub-contractors delivering on the site of the new offices materials ordered for the building. The Ministry, however, reserve any right to act in countermanding this arrangement and they stipulate that no work of construction must proceed without a licence.

In a report presented at last Friday's meeting of the board the committee state that the interruption of the building operations involves additional expenditure in placing the partially-erected buildings in a proper state of protection against the weather. Thus, the upper courses of the unfinished walls had to be covered in, exposed ironwork painted, other work had to be floated with cement, and some of the floor construction protected by asphalt. Exposed window openings should be closed with felt and temporary roofs placed over the central hall, board room, &c. The execution of these works had been approved by the Ministry of Munitions.

The cost of these protective works might amount to £3,500, and a question had arisen with the contractors as to whether they or the board were liable for such cost. In the opinion of counsel, the liability rested with the contractors under the terms of their contract, but the contractors did not accept this position.

Counsel further advised that the best course would be for the board's architect to give a written notice to the contractors to cover down and secure the work during the time the building operations were suspended under the Order of the Ministry of Munitions. He advised also a further notice to the contractors, signed by the clerk of the board, that unless the notice from the architect be complied with and work commenced within fourteen days and continued and completed with due diligence, the board would enter upon the building and do the necessary work at the expense of the contractors, deducting the cost from the retention moneys now in the possession of the board. These retention moneys amounted to £7,835.

The committee added that it might be that the cost of the protective works would become the subject of compensation to the contractors by H.M. Government under the Defence of the Realm Losses Commission. The Ministry of Munitions, however, stated that compensation was paid *ex gratia*, and that the Minister was unable to advise whether this instance would be recognised by the Defence of the Realm Losses Commission as entitling to compensation.

INSTITUTION OF WATER ENGINEERS.

WINTER GENERAL MEETING.

The twenty-first winter general meeting of the Institution of Water Engineers will be held at the apartments of the Geological Society, Burlington House, W., on Friday, December 8th, commencing at 2.45 p.m.

The following papers will be read and discussed:—

(1) "The Cross Hill Covered Service Reservoir for the Birkenhead Corporation," by W. J. E. Binnie, M.INST.C.E., B.A.(Cantab).

(2) "The Rating of Waterworks," by Charles Clifton, P.A.S.I.

Dr Sidney Barwise, president-elect, will occupy the chair.

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

ANNUAL GENERAL MEETING.

The annual general meeting of this body will be held at the Holborn Restaurant, London, W.C., on Thursday, December 7th, at 2 p.m., when Dr. Samuel Rideal, F.I.C., F.C.S., will read a paper, entitled "Can Explosives be Manufactured on Sewage Works?" and Mr. Charles Terry, Canterbury, one on "Modern Sewage Purification Works: Their Design, Construction and Maintenance."

CONCRETE INSTITUTE.

PROGRAMME OF SESSION 1916-17.

Meetings of the Concrete Institute for the 1916-17 session have been arranged as under:—

December 21st.—Prof. Henry Adams, M.INST.C.E., on "Pile Driving and the Supporting Power of Piles."

January 25th.—Mr. C. R. Peers, chief inspector of ancient monuments, H.M. Office of Works, on "The Care of Ancient Monuments."

February 22nd.—Mr. Robert N. Sinclair on "Southampton Docks, Re-modelling of an Old Dry Dock."

March 22nd.—Mr. W. Cleaver on "The Rational Design of Reinforced Concrete Wharves and Jetties, with particular reference to those for Wet Docks, having a Permanent Water Level."

April 26th.—Mr. S. Bylander on "Secondary Stresses in Structural Steel."

The meetings will be held at Denison House, 296 Vauxhall Bridge-road, Westminster.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have, we are informed by the secretary, Mr. Alfred R. Potter, been arranged as under:—

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., A.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Prof. S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffries (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act, with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

ASSISTANT SANITARY INSPECTOR.—December 4th.—Barnsley Town Council. £120 per annum.—Mr. W. P. Donald, town clerk, Town Hall, Barnsley.

SEWAGE FARM MANAGER.—December 4th.—East Barnet Valley Urban District Council. £2 10s. per week, with free house.—Mr. T. A. Buckley, clerk, Council Offices, Station-road, New Barnet.

ASSISTANT SURVEYOR.—December 8th.—Beeston Urban District Council.—Mr. George F. Greenwood, engineer and surveyor, Public Offices, Beeston, Notts.

ROAD FOREMAN.—December 8th.—Beeston Urban District Council.—Mr. George F. Grimwood, engineer and surveyor, Public Offices, Beeston, Notts.

SURVEYOR AND WATERWORKS MANAGER.—December 8th.—Queenstown Urban District Council. £130—£160 per annum.—Mr. J. H. Campbell, town clerk, Town Hall, Queenstown.

CHIEF ELECTRICAL ENGINEERING ASSISTANT.—December 9th.—Corporation of Leeds. £350 per annum.—Mr. C. Nelson Hefford, manager, 1 Whitehall-road, Leeds.

FIRE BRIGADE SUPERINTENDENT.—December 9th.—Coulsdon and Purley Urban District Council. £156 per annum.—Mr. E. J. Gowen, clerk, Council Offices, Purley.

DRAUGHTSMAN.—For Sandling Division, R.E., Kent.—Division Officer, R.E., Sandling, Kent Division.

JUNIOR ASSISTANT.—Newark-on-Trent Corporation.—Borough Engineer, Newark-on-Trent.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

LEON (Spain).—August 15th.—Schemes are invited for a water supply, and also for the improvement of the sewerage system. A prize of £1,000 will be awarded to the author of the selected scheme.—Secretaria del Ayuntamiento, Leon, Spain.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

WALLSEND.—December 4th.—For removing the existing corrugated iron roof of an elementary school and providing and fixing a boarding and felt roof, for the corporation.—Borough Surveyor, Town Hall.

NOTTINGHAM.—December 5th.—For the erection of four shelters and additions to the boiler-house at the isolation hospital, for the Health Committee.—City Architect, The Guildhall, Nottingham.

ALNWICK.—December 9th.—For repairs to a cart bridge, for the rural district council.—Mr. W. H. Walton, clerk.

ISLE OF WIGHT.—December 15th.—For alteration to a school, for the county council.—Mr. J. Dufton, clerk, County Council Offices, Newport, I.W.

Engineering: Iron and Steel.

WEYMOUTH.—December 5th.—For works on the pile pier for strengthening the quay wall and stone steps, for the corporation.—Mr. K. J. S. Harris, borough engineer, Municipal Offices.

DUNFERMLINE.—December 8th.—For supplying and laying about 6 miles of cast-iron pipes from 20 in. to 9 in. diameter, together with the construction of incidental works, for the corporation.—Messrs. Crouch, Hogg & Easton, engineers, 14 Blythswood-square, Glasgow.

SUNDERLAND.—December 9th.—For the installation of a steam turbine, alternator, and condensing plant, at the electricity works.—Mr. A. S. Blackman, manager, Electricity Offices, Dunning-street, Sunderland.

LEICESTER.—December 9th.—For the supply of cast-iron pipes and connections, for the Gas Committee.—Mr. H. Pooley, engineer and manager, Gas Offices, Millstone-lane, Leicester.

JOHANNESBURG.—December 9th—January 3rd. For the supply of 1,427 house service electricity meters, seven switchboard meters, and 100 time switches, for the municipal council.—Commercial Intelligence Department, 73 Basinghall-street, London, E.C.

SHEPSHED.—December 11th.—For the supply of a Cornish boiler and a horizontal steam engine, for the urban district council.—Mr. R. Smith, clerk, Shepshed, Leicester.

JOHANNESBURG.—December 15th.—For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St Dunstan's-hill, London, E.C.

WOLVERHAMPTON.—December 15th.—For heating and hot-water apparatus, for the Board of Guardians.—Mr. F. Harrison, clerk, Poor-law Offices, Wolverhampton.

DURBAN.—January 3rd.—For the supply of a 3,000-kw. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation.—Electricity Department, Dock-road, Cape Town.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Iverell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

The Surveyor

And Municipal and County Engineer.

Vol. L. DECEMBER 8, 1916. No. 1,299.

Minutes of Proceedings.

Hypochlorite Sterilisation of the London Water.

Dr. Houston, in his twelfth research report to the Metropolitan Water Board, states that "one effect of the war now waging may be to render water supplies exposed to pollution more dangerous than previously, owing to the increased number of disease carriers." Another effect may be the difficulty of inducing water authorities to provide adequate funds for purification purposes. Further, it appears that the quality of the river water used for the supply of London has actually deteriorated. The reservoirs which were absolutely essential in the first place for purposes of quantity have hitherto been the means of improving the quality of the water stored, but in the case of London this method of purification involves much expense for pumping which would otherwise not be required. Thus the war has produced two conditions which have caused the Metropolitan Water Board to make certain changes, partly in order to save pumping expenses and partly in order to make sure that the water was purified more fully than was possible by the method of storage. They have, in fact, at last adopted the method of sterilisation by means of hypochlorite.

Our readers will remember that for years past we have drawn attention to Dr. Houston's clear warnings that some further treatment was required for the London water. For instance, in the year 1912, speaking of his sixth annual report and of the treatment of flood waters taken into the reservoirs, our comment was: "Why the board have neglected to follow this advice is inconceivable. The risk run is extraordinary, and the saving of expense cannot be great." Or again, in an article which appeared earlier in the same year, dealing with Dr. Houston's eighth report on research work, we said: "What stronger criticism of present methods is required than the words in clause (*c*), page 8, of the report?: 'In any case, I am quite unable to support the view that the safety conferred by storage affords a sufficient pretext for the ill-considered abstraction of the river water of most undeniable quality.' In my reports to the Water Board I have urged again and again that this *specially impure* water should either be excluded from the storage reservoirs or *purified antecedently*." One of our concluding comments on this report was: "The chief lesson of this report is that *sterilisation of the London supply is necessary and possible*."

The advantages of hypochlorite sterilisation have been stated in these pages at great length for years past, and we have on many occasions commented upon the slowness of water authorities in this country to appreciate the advantages of the method. Now at last we find that the Metropolitan Water Board has grasped the fact that these advantages actually do exist, and their new policy is explained and justified by Dr. Houston in the following words: "The practice of the Water Board has been to circulate the river water through the storage reservoirs, in order to improve its *quality*. This involves the expenditure of a large sum of money, as the water, in most cases, has to be pumped into reservoirs. An alternative and much cheaper plan (where applicable) is to leave the reservoirs full, and pass the river water direct on to the filter beds after it has undergone a process of treatment" [hypochlorite sterilisation], "which purifies it to a higher standard than if stored water were used." The results have been very satisfactory, the quality of the water being good and the financial saving considerable. Further, until this report was published, nobody had any idea that the water was being sterilised, which is the best answer to the suggestion so often made that sterilisation by means of hypochlorite must result in unpleasant tastes and odours. The importance of this step is very great, as the example of the Metropolis will certainly impress provincial authorities in a manner that could not result from the most successful application of the method abroad or elsewhere in this country. It is the more important at the present time both for reasons of general safety and for economy. Further, it affords an excellent example of the manner in which public money may be saved by employing a highly qualified scientific adviser and following his advice.

* * *

Safety First.

In our last issue we drew attention to the conference convened at the instance of the London General Omnibus Company to consider the advisability of forming a representative "Safety First" Council, with a view to minimising the dangers to foot passengers caused by existing traffic conditions in the Metropolis. We then expressed the hope that there would be a general response to the invitations that had been issued, and that the primary object of the conference, namely, the formation of a council would be achieved. The conference was duly held on Friday last, when a thoroughly representative attendance was secured. The whole trend of the speeches was in the direction of emphasising the need for educating the public, and incidentally the drivers of vehicles, in regard to the avoidance

of danger *on the assumption that existing conditions remain unchanged.* Some speakers, it is true, were bold enough to say that the present drastic restrictions on street lighting were unnecessary as a provision against promiscuous bomb-dropping, while others advocated greater uniformity in the lighting of vehicles. It does not appear to have occurred to anyone, however, that the simplest and most practicable method of securing the public safety, both by day and by night, is by a drastic reduction of speed and a more thorough regulation of traffic by the police. It can be demonstrated from available statistics that reduced street lighting is *not* the chief cause in the appalling increase in the number of street accidents and fatalities in the streets of the Metropolis in recent years. Thus, *before the war*, the number of fatalities in the Metropolitan police area rose from 155 in 1904 to 537 in 1912, while the number of injuries in the same period increased from 10,384 to 20,186. It is a little difficult to see how these figures can be explained by those who attribute the present dangerous state of affairs to the lighting restrictions imposed in consequence of the war. Moreover, it must be borne in mind in estimating the factors which contribute to street accidents that even if the streets are darker at nights than they have ever been before, this darkness is accompanied by an enormous decrease in the volume of foot passenger traffic. Statistics do not appear to be available—at any rate, we have seen none—as to the relative number of accidents which occur in daylight and after dark, and such figures, if they were obtained, would be of great assistance in defining the problem to be solved.

For our part, we entirely agree with our contemporary the *Daily Telegraph* that many members of the public have formed a very definite opinion of the way in which fast-moving vehicles are being driven in the London streets just now. The opinion is that there is far too much reckless driving. We repeat what we said last week, that one immediate step to be taken is the education of drivers and of the general public in the best methods of minimising the danger and risks which must arise from existing conditions. But we go further than this, for it is after all of little use to talk about "educating" people as to the proper way to cross the road when 'buses, trams, taxis and private motors are allowed to tear about as at present. What is undoubtedly necessary is a drastic reduction of the speed limit, not only by night, but by day. The dangers are just as great, if not greater, by day than by night, because of the larger number of people who are about. Not only should there be a reduction of speed, but we cannot help thinking that the police should arrange for an extension of the City system of holding up the traffic at busy points to allow of pedestrians crossing the road in safety.

* * *

Industrial Research.

Of the many lessons which the war has brought home to the mind of the nation, not the least important is that of the prime necessity for organised industrial research with Government assistance. If British industry is to hold anything like its former place in the markets of the world during the after-war period, it is now generally recognised that research work must be undertaken on an entirely different scale from that provided by the isolated efforts of individual firms, which have hitherto formed our chief activity in this direction. It was therefore all to the good that Mr. Wentworth-Sheilds should have dealt with this subject in some detail in the course of his excellent inaugural address as president of the Concrete Institute. The history of Government assistance in the past may be summed up in very few words. The National Physical Laboratory was established in 1900, but with a grant of only £4,000 a year it is obvious that it could not achieve very much. Add to this the financial assistance afforded to the Engineering Standards Committee and the Imperial College of Science, and we have the sum total of what has been done by the Government. If this be compared with the action of the American Government, which has been in the habit of subsidising their Bureau of Standards to the extent of something like £100,000 per annum, our own efforts fall into insignificance. Since the war broke out, however, rather more has been done. In July, 1915, a special committee of the Privy Council was formed with a strong Advisory Council, over which Sir William McCormick presided. This body, which was empowered to spend a sum of £25,000 during the year 1915-16, has done much good work. As an example, we may mention the investigation into the matter of the deterioration of timber, metal, and concrete in sea water, a subject which is of special interest to municipal engineers in seaside towns. Nor has the Concrete Institute itself been idle, for, as pointed out by Mr. Wentworth-Sheilds, that body has, with the help and co-operation of the professors of several British Universities and technical colleges, drawn up a most useful programme of tests to ascertain the best way of using various concrete aggregates obtainable in large quantities in all parts of the country. On the general question, we quite agree with Mr. Wentworth-Sheilds that any industrial research, if quick and practical results are to ensue, should be undertaken under the guidance of men who not only have scientific knowledge, but who are also acquainted with the actual working of the industry for the benefit of which the research is instituted. This means close co-operation between the laboratory and the works, between the professor and the manufacturer. Further, it means co-operation rather than rivalry between individual firms interested in the research. It is to be hoped that these practical considerations will be fully borne in mind in any further Government scheme of State-aided research which may be undertaken.

* * *

War Prisoners and Road Work.

The question of utilising the services of prisoners of war on work of national importance is a very pressing one in view of the absolute necessity of conserving all our resources of man power at the present juncture. It is therefore with no little interest that we observe that the Kent County Council have had under consideration the question of the possibility of making use of these prisoners in connection with the maintenance and repair of roads. At a recent meeting of the council a definite motion was under discussion expressing the opinion that it is absolutely necessary in the national interests that the services of prisoners of war interned in this country should be applied in the direction of the repair and maintenance of the various county council highways throughout the United Kingdom. It was further decided that a copy of this resolution should be forwarded to the Prime Minister, the Secretary of State for War, and the President of the Local Government Board, as well as to the clerks of all other county councils, with the request that they will bring the matter before the notice of their respective authorities, with a view to the adoption by them of a similar resolution. The mover of the resolution pointed out that it had been laid down by the Hague Convention that prisoners of war can be used for ordinary work in the country where they are interned. He further made some remarks about the present conditions of the main roads of the county to which excep-

…was taken by subsequent speakers. Indeed, he went so far as to say that the main roads would be gone altogether if some action were not taken quickly. In saying this, he certainly went further than the facts would seem to justify. Indeed, his seconder definitely objected to any reflection being cast upon the surveyor of the Bridges and Roads Committee, and pointed out that the condition of the roads was extraordinarily good considering the difficulties that have been experienced with regard to labour and material. The upshot of the discussion was the moving of an amendment expressing the opinion that it is desirable in the national interests that the services of prisoners of war should be utilised in work of national importance, such as in the direction of the repair and maintenance of various county council highways throughout the United Kingdom. The mover and seconder agreed to accept this in place of the original motion, and it was carried, special reference being made to the necessity of restoring the road between Dover and Folkestone. The principle involved in the employment of prisoners of war on useful work of national importance is quite a sound one. Moreover, it is probably one to which the prisoners themselves would offer no objection, as they would probably be employed rather than spend their time in idleness in the camps. It is satisfactory, however, that the original motion was amended, as otherwise some reflection on the county surveyor might have been implied, a reflection which was probably not intended and certainly not deserved.

The Scottish Housing Congress.

The National Housing and Town Planning Congress held recently at Glasgow passed a series of resolutions urging the preparation of housing schemes in anticipation of the close of the war; the provision by the Government of the necessary capital to enable these schemes to become effective, the necessity of giving local authorities powers to stimulate and aid constructive housing schemes; the need for town planning schemes; and the desirability of building self-contained dwellings with gardens instead of tenements. This is a comprehensive programme, whose realisation, however desirable, can hardly be expected in the near future in Scotland, where the work of undoing the sins of the past must necessarily be prolonged and expensive. This view, we note, is virtually conceded by the *Glasgow Herald* in commenting upon the congress. "It is admitted," says the writer, "even by the idealists of the Scottish National Congress, that cottages, of however humble a sort, are unhappily not possible in the most congested of urban areas. Where population exceeds a certain density the tenement is inevitable, and a good tenement is infinitely better in every way than overcrowded and sub-divided houses masking as 'cottages' and 'mansions.' The drawback of the traditional Glasgow tenements is that they are not good enough even of their kind. They are too closely massed, too high in proportion to the breadth of the street, they are deficient in light and air, and unnecessarily, almost wantonly, drab and monotonous in design."

After such condemnation as this, it was hardly necessary to warn the Glasgow Corporation that such defects must be rigorously guarded against in any dwellings erected by them, but we must trust all the same that the advice will not go unheeded. The town tenement, which is so general in Scotland, it is allowed by our contemporary, does not represent the ultimate ideal in housing, and it is regarded as "significant" that it has practically no place in the dreams of the town planners. What is capable of being done upon a more approved plan may be witnessed within hail of Glasgow, where, in the "garden cities" formed by the Middle Ward District Committee of Lanarkshire, single-storey houses with gardens have been built. These, it appears, even at war cost, are being let at economic rents less than would be charged for inferior houses, nominally of the same accommodation, in city tenements verging on the "slum" level. They are in fact a striking sample of what can be accomplished in housing reform, and to this extent they tend to prove that there is ample room in Scotland for the ideals with respect to improved housing conditions to which expression was given at the recent congress.

* * *

Clinker Mexphalte Roads.

In another column will be found an article in which Mr. Lionel Lewis, the engineer and surveyor to the Abertillery Urban District Council, describes the results obtained by the use of clinker Mexphalte on certain of the roads in that district. It is certainly to the credit of the Abertillery Council and their surveyor that such a modern process has been adopted on their roads. We have pointed out time and again the dangers of any undue reduction of expenditure in road construction and maintenance, in spite of the temptation to pursue such a policy in these days of drastic economy. We now have reason to believe that some highway authorities are already feeling the results of their unwisdom in this respect in the early days of the war, and not a few must be wishing that they had adopted some modern process, such as that which Mr. Lewis has found to be so successful. The best test in his district is provided by Oak-street, where, owing to the very hilly nature of the district, the heavy lorry horses have shoes with large caulks to give them a foothold. In spite of this, and of the consequent marking of the surface in hot weather, it has been found that any impressions that may be made rapidly disappear. Mr. Lewis makes a sound point in emphasising the resilience of a Mexphalte carpet, which also possesses the advantage, among others, of providing a definite and profitable use for refuse destructor clinker.

* * *

By-law Administration.

It is a cardinal principle of by-law administration by local authorities that when once by-laws have been passed and received the confirmation of the appropriate Government department, the local authority have no power to dispense with them in individual cases unless the by-laws themselves contain a suspending power which, of course, is practically never the case. At a recent meeting of the Plans Committee of the Middlesbrough Corporation, a discussion involving this issue was raised on an application to erect a structure in a yard, the effect of which would be to reduce the air space below the minimum fixed by the by-laws. One member complained of the frequency with which such applications were made and sanctioned, and went so far as to say that the air-space by-law was honoured more in the breach than the observance. If this be true, it discloses a very serious state of affairs, and it is to be hoped that a legal remedy may be found. The air-space by-law is one of those which most directly affect the public health, and it cannot but be regarded as a misfortune for any town—particularly where the working classes congregate—when it is not strictly enforced. We intend no reflection on the Middlesbrough Corporation, as we are in ignorance of the facts, except in so far as they are disclosed by the proceedings at the meeting in question. It is satisfactory that the plan there under discussion was not approved.

Local Authorities and Food Production.

THE UTILISATION OF VACANT BUILDING LAND.

By JOSEPH JUBB, Clerk to the Bognor Urban District Council.

The recent letter of Mr. Bridges, the surveyor of the Bognor Urban District Council, upon the subject of the cultivation of unused building plots* having apparently created a certain amount of interest among the councils of other towns in the country (as is evidenced by the number of letters which have been received by him asking for further information with regard to this matter), I think it would be interesting to your readers to have some particulars as to the inception of the scheme and the details as to how it operated in Bognor.

The question was first raised in Bognor in the early part of this year in consequence of the excessive increase in the price of foodstuffs, which was then becoming so noticeable as to receive the earnest attention of all serious-minded people. At the meeting of the council held in April last, as a result of the discussion of the matter, the following resolution was passed:—

"That this council view with grave concern the increase in the price of food which is daily taking place, and requests the Government to inaugurate some scheme of national food control, with a view of combating this serious menace to the country's welfare. That a copy of this resolution be sent to the Prime Minister and the President of the Local Government Board."

With a view of themselves assisting in carrying into effect the principle they were advocating the Government to adopt, the council resolved as a first step to hire as many as possible vacant plots of land in the town for the purpose of sub-letting them to persons who would be willing to cultivate them for the production of food during the present crisis; and, secondly, the clerk was instructed to write to the Local Government Board and ascertain whether, under the exceptional circumstances which obtained, if the council should employ labour and cultivate the land for the growing of such food essentials as potatoes, &c., the board would sanction expenditure on tools, implements, seeds, &c., and for labour for working the land.

It will be seen here that the council had in mind practically two separate schemes (*a*) the ordinary hiring of land to allotment holders, and (*b*) the engaging of labour for the cultivation of the land, the council providing seeds, implements, &c., and themselves disposing of the produce. The difficulty with regard to scheme (*b*) was accentuated by two factors (1) the lack of legal authority for expenditure by a council for such purpose, and (2) the scarcity of labour. It was, however, anticipated that, by taking large plots of land, the use of a plough and other agricultural implements might lessen the labour required, and at the same time expedite the production of food. It was finally resolved to proceed with scheme (*a*) forthwith, and for the purpose of ascertaining the number of persons who would be prepared to take up allotments a handbill was distributed in the town requesting such persons as were desirous of taking up allotments to give their names to me, the clerk to the council; and with regard to scheme (*b*) to convene a public meeting with a view of laying the scheme before the public and ascertaining if sufficient labour could be obtained for cultivation of such of the larger plots in the town as the council might undertake to utilise for food production.

PROCEDURE AT BOGNOR.

Prior to the public meeting being held I communicated with the owners of all the vacant building plots in the town, pointing out the vital importance of maintaining the food supply of the country, and asking them whether, in view of the present crisis, they would grant the use of their land for the cultivation of foodstuffs. The replies were most encouraging, and, as a matter of fact, when the public meeting was held I was enabled to state that the council had at their disposal no less than 12 acres of vacant land.

The meeting was a most enthusiastic one, and offers to take land were so numerous that before the conclusion of the meeting more than 8 acres had been allotted to intending cultivators in small portions of from 10 to 20 rods, and, as a matter of fact, within a fortnight afterwards the whole of the land had been snapped up by allotment holders. The opinion of the meeting generally was that, in view of the cordial response to the appeal to take up private allotments, the question of the greater scheme (*b*) should be deferred for the present. The rent for the land was fixed at 6d. per rod per annum, and the council, beyond staking out the allotments, undertook no other liability with regard to the land. They have, however, as a matter of fact, in many cases where the land has been open, supplied allotment holders with timber for posts, wire, &c., for fencing, leaving it to the men themselves to find necessary labour for putting up the fence.

The whole of the owners of the land approached in the matter consented to let the council have the use of the land free of charge, in some cases at six and in others at three months' notice, with a clause inserted that should the land be required for building purposes a month's notice only should be given. In the latter event it is provided that, if it is considered that the tenant is entitled to be compensated for his crop, the council should pay the compensation, but as during the present abnormal times building operations are stagnated it is not anticipated that any such cases will occur. Since April last another 4 acres have been granted to the council, making in all 16 acres of land which is now under cultivation and in the hands of nearly 200 allotment holders—a number of whom are women. Most of the holders are working men, but there are several cases of independent people having taken plots, and it is gratifying to find that there are few or none who have not made a success of their venture and provided an object-lesson of what application can do.

Most of the allotments are in lots of 10 rods, but in a number of cases 20 and even 30 rods have been taken up by one person. If, however, sufficient land could not be obtained, it is suggested that each holder should be limited to 10 rods. The usual form of agreement for hire of allotments, prints of which can be obtained from the publishers of local government forms, is used between the council and the tenants, and all rents are payable in advance. There is no intention on the part of the council to make a profit out of the undertaking, and all surplus rents will be devoted to improvements in the land.

LOCAL GOVERNMENT BOARD ATTITUDE.

With regard to the greater scheme (*b*), I wrote to the Local Government Board asking them whether, under the exceptional circumstances which at present obtain, they would sanction an expenditure under the Local Authorities (Expenses) Act, 1887, for the hire of tools, implements, seeds, &c., and for labour for working the land, and received a reply to the effect that, while Mr. Long appreciated the motives of the council in submitting this proposal, it did not appear to him that expenditure by the council on the scheme suggested could properly be sanctioned under the Act in question, but that the council might take steps with a view of forming a local voluntary body for the purpose on the lines indicated by the leaflets issued by the Board of Agriculture and Fisheries. As, however, the available land had been taken up by allotment holders, this matter was not pressed further, but I believe that the board may now view in a much more favourable light an application for sanction to a like proposal, and as the council have now provisionally arranged for taking over 20 acres of land they may probably approach the board again if they find there is sufficient labour available to work the ground. As, however, it would appear from a report of a speech of the Earl of Crawford in the House of Lords, on November 29th last, that the Board of Agriculture are about to issue Orders, under the Defence of the Realm Act, which would make the acquisition of land for the purpose of small allotments and market gardens more easy, probably the Local Government Board would now be inclined to extend to councils facilities which they do not at present enjoy, and there may be even initiated a system of subsidy by the Government to local authorities for the purchase of seed, hire of agricultural implements,

* THE SURVEYOR, November 22nd, p. 483.

&c. At any rate, Bognor has by voluntary effort anticipated the Government's proposals, and having regard to the patriotic manner in which the owners of land in the town have acted, the necessity of a compulsory order will not arise there.

STATE'S NEW POWERS.

The new powers of the Board of Agriculture in respect of the acquisition of land for cultivation as allotments and market gardens which were foreshadowed by Lord Crewe in the House of Lords on November 29th are declared in amendments to the Defence of the Realm Regulation contained in an Order in Council published on Wednesday night. A new regulation empowers the board, for the purpose of maintaining the food supply, to enter on uncultivated or common land (including town and village greens) without consent, and on other land with the consent of the owner and the occupier, and to cultivate it or arrange for its cultivation. Provision is made for the compensation of the person cultivating the land under certain conditions and of any person injuriously affected by the deterioration of the land.

ACTION BY LOCAL AUTHORITIES.

Eastbourne Corporation is to arrange with the owners of waste land to allow it to be used for potato growing.

Manchester City Council on Wednesday appointed a Special Committee to inquire as to how much vacant land in the possession of the corporation could be used for the production of foodstuffs.

West Hartlepool Town Council have appointed a Special Committee to go into the question of the cultivation of vacant ground in the borough, and an effort is to be made to bring under cultivation next year all available land.

Hastings Town Council have decided to take in hand the question of cultivating food supplies. A proposal that vegetables should be grown in the parks instead of flowers has not found approval, but the borough engineer, Mr. P. H. Palmer, has prepared a report showing how much vacant land could be cultivated.

EXPERIMENTS ON EARTH-PRESSURES.

By PONSONBY MOORE CROSTHWAITE, B.A.I., M.INST.C.E.

[Abstract of a paper read on Tuesday last at a meeting of the Institution of Civil Engineers.]

The paper commences with a short account of Rankine's theory of earth-pressure, and the principles and assumption on which it is founded. Descriptions of former investigations are given in some detail—namely, those of the late Sir George Darwin and Messrs. Goodrich, Wilson, Bell, and Meem. The author concludes that of the experiments made by these investigators to investigate the lateral pressure of earth, those in which model walls were used are of greatest value, but points out that if models are of any size the experimental difficulties are almost insuperable.

The author's experiments, a number of which are described and illustrated in the paper, were made by loading a plunger with known weights and measuring the penetration when the plunger had come to rest after the application of each weight. The materials were enclosed in an open bucket, and their weight was determined.

With those data the value of ϕ, the angle of internal friction, can be obtained from Rankine's well-known formula for the safe depth of foundations—

$$d = \frac{P}{W}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$$

when d denotes the penetration, P the pressure in pounds per square foot, and W the weight of the material in pounds per cubic foot.

If the formula is true, and the pressures be plotted against the penetrations, the resulting curve is a straight line, and ϕ as calculated from the formula should equal the angle of repose.

With sand, garden earth, and cinders and ashes the resulting curves are straight lines, but it was found that the value of ϕ varied with the state of aggregation of the materials (i.e., whether it was lightly poured into the bucket, shaken in, or well pounded in. When the material was deposited in the bucket as lightly as possible the angle of internal friction was the same as the angle of repose, but with more consolidation the angle was much greater.

From these materials the author concludes that Rankine's theory holds, provided the proper angle of internal friction is used and not the angle of repose. If, however, this angle is used it would be necessary to introduce a factor of safety into the formula, for a wall designed with it one would be theoretically just strong enough and no more. In Rankine's formula there is no factor of safety, and it is concluded that Rankine saw this, and used the angle of repose as covering the worst conditions that need possibly be provided for. The author's experiments show that, for the materials tested, work designed by Rankine's formula using the angle of repose, would have a factor of safety of 2½ to 4, and he considers that these are not unreasonable figures for such materials.

The experiments on clay give altogether different results, for instead of the penetration varying as the load, it varies as the square of the load, and the penetration curves are parabolas. These results, which were altogether unexpected, are completely confirmed by larger experiments carried out by Messrs. Coode, Matthews, Fitzmaurice, and Wilson, and by Mr. McAlpine in New York.

The author is able to give no physical explanation as to why the penetration in clay should vary as the square of the load, but leaves it to the physicists. The law must be capable of some rational explanation, and, if true, it upsets all earth-pressure theories when they are applied to clay, for all accepted theories assume that the angle of internal friction is the same as the angle of repose, and that its value is independent of the pressure. It is suggested that the subject is worthy of further investigation, but that such could hardly be made by a private individual, for the work is tedious, each experiment taking from twenty-four to forty-eight hours. Moreover, if the investigation is to be properly carried out, physical and chemical analyses of the clays will be required that could only be made in a well-equipped physical laboratory.

In connection with the earth slides experienced at the Panama Canal, it has been suggested that in clay and shale cuttings there is a critical depth beyond which the slides will not stand, and the author's experiments on clays clearly show that for these this must be the case. Where ϕ is independent of the pressure the depth of the cutting cannot affect the stability of the slope, but where the angle decreases with the pressures it is evident that eventually a depth will be reached beyond which its sides will not stand.

This decrease is clearly shown in one experiment on mud for which the angle for a pressure of 0·25 ton per square foot was 17° – 15′, which decreased to 2° 10′ at a pressure of 1·25 ton per square foot, when it was little better than a liquid.

Institution of Mechanical Engineers.—A paper dealing with the subject of variable-speed gears for motor road vehicles will be read by Mr. Robert E. Phillips at a meeting of this body on Friday next, the 15th inst., at the Institution of Civil Engineers. The chair will be taken at 6 p.m.

Scottish Housing Commission Report.—In reply to a question in the House of Commons, the Secretary for Scotland stated that he was anxious that the Scottish Housing Commission should complete and issue its report at the earliest possible date, and that he was doing all he could to secure that object. He was informed, however, that the report could not be expected for some months to come.

Road Making in France.—The Merton and Morden Urban District Council have, at the request of the county surveyor (Mr. A. Dryland), submitted the names of two of their workmen who could be spared, if willing, to join the unit which is being raised for road making in France, and it has been agreed that their positions shall be kept open for them, and that while on service they should be paid full wages, less Army pay and allowances. The surveyor (Mr. G. Jerram) stated that he had submitted himself as a candidate for a commission in the new unit.—With regard to the county surveyor's inquiry whether the council had any plant available for use by the road-making unit, it being understood that the council will be repaid the cost to which they are put in replacing such plant, or alternatively its agreed value, the district surveyor has been authorised to offer three tumbler carts and one horse broom.

Hypochlorite Sterilisation of London Water.

By Dr. A. C. HOUSTON, Director of Water Examination, Metropolitan Water Board.

[In the case of London's water supply, storage reservoirs are absolutely essential for purposes of quantity. The practice of the Water Board has been to circulate the river water through the storage reservoirs, in order to improve its quality. This involves the expenditure of a large sum of money, as the water, in most cases, has to be pumped into the reservoirs. An alternative and much cheaper plan—where applicable—is, says Dr. Houston, to leave the reservoirs full, and pass the river water direct on to the filter-beds, after it has undergone a process of treatment which purifies it to a higher standard than if stored water were used. The saving involved may be as great as 10s. per 1,000,000 gallons. During the summer months, this treatment which is described in the subjoined extract from Dr. Houston's twelfth research report—has been applied experimentally, with the most successful results, to about 75,000,000 gallons of water per day. The treated river water, as it reached the filter-beds, has been tasteless, free from any noxious ingredient, and purer than stored water, the life of the sand filters has been considerably prolonged, and the consumers have received an innocuous and palatable supply, reaching an exceptionally high standard of bacteriological purity. During the winter months, the continuity of the treatment will suffer some interruption, a scientifically controlled compromise between the use of treated water and stored water being necessary when the Thames is in flood.]

Early in 1905 the writer* sterilised the Lincoln water supply (population above 50,000) by means of chloros.† The treatment was continued up to 1911, when a new supply was introduced. The best series of results occurred during a period of about ten months, when sixty-two samples, collected consecutively, contained no typical B. coli even in 100 c.c. of water.

In 1908 Johnson treated successfully the Bubbly Creek water at Chicago with chloride of lime. Since that date the use of hypochlorites for sterilisation purposes has increased in the United States by leaps and bounds, and the results obtained have usually been successful beyond the expectations even of the most ardent advocates of this method of treatment.

One effect of the war now waging may be to render water supplies, exposed to pollution, more dangerous than previously, owing to the increased number of disease "carriers." Another effect may be the difficulty of inducing water authorities to provide adequate funds for purification purposes.

Inasmuch as sterilisation is a cheap method of rendering water "safe" for drinking purposes, it is not unlikely that the future may see sterilising processes more in vogue than at present. Aberdeen has set a remarkable example economically‡ in this connection. The results of the writer's "excess lime" experiments led Aberdeen to give the process an exhaustive trial. The nett result was that Parliament approved last year (1915) the principle of a threefold scheme of purification (excess lime treatment, storage for seven days and filtration at about double the ordinary rate), the saving in capital cost as compared with alternative schemes exceeding £100,000.

It was found that with the exceptionally soft Dee water sterilisation could be effected within seven days with about 1 part of CaO per 100,000 parts of water (= 1 lb. per 10,000 gallons). The actual excess of CaO, beyond that required to neutralise the dissolved and half-bound carbonic acid in the water, was very slight.

Of course, there are comparatively few water supplies quite so soft as that of Aberdeen, and in the case of really hard waters the amount of lime required for sterilisation purposes is so material as to be almost prohibitive, if the advantages of a softened water are not allowed to enter into the calculation.

Reverting to hypochlorite sterilisation, the following notes may be of some service to those who, rightly or wrongly, favour this method of treatment:—

LABORATORY EXPERIMENTS.

The experiments were carried out in the laboratory with raw Thames water during the flood months of the year (December to March).§ The doses used were 1 in 800,000, 1 in 1,600,000, 1 in 3,200,000, and 1 in 6,400,000, in terms of available chlorine, or in terms of bleaching powder 37·5, 18·75, 9·38, and 4·7 lb. respectively per 1,000,000 gallons. The period of contact was one, five, and twenty-four hours.

The advantage of five hours' contact over one hour is very material, a much smaller dose being required for sterilisation purposes.

The advantage of twenty-four hours over five hours is certainly appreciable, but it is perhaps hardly material from the practical point of view. This being so, these twenty-four-hour results will, for economical reasons, as regards printing expenses, not be dealt with. For the same reason the collective results will alone be considered. The bottles (glass stoppered) were kept in the dark in the laboratory, the extremes of temperature being 47 to 78 deg. Fahr.

The average chemical condition of the raw river water was as follows:—

PART PER 100,000.

Raw Thames river water.	Ammoniacal nitrogen	Albuminoid nitrogen	Permanganate test at 80° F.		Colour in m. brown 2 ft. tube	Turbidity.
			5 mins.	3 hrs.		
Average during period of experiment	·0096	·0180	·1243	·3540	159	3·35
Average for the year 1915... ...	·0075	·0165	·0827	·2265	95	1·49

It will be seen that the results are considerably worse than the averages for the year 1915.

As regards the bacteriological quality of the raw river water, it may suffice to say that the great majority of samples contained B. coli in 0·1 c.c.

Sterilisation was judged by incubation of 100 c.c. of the shaken sample in a lactose bile-salt medium (forty-eight hours at 37-40 deg. Cent.).

The presence of "active chlorine" was judged by a blue tint on addition of a solution of potassium iodide and starch (without acid).

The bacteriological results are shown in the accompanying table [see next page].

Taking one hour's contact first, it will be seen that a dose of 1 in 800,000 was effective in over 75 per cent of the samples. Half the dose was effective in 16 per cent of the cases, but smaller doses were always ineffective.

On the other hand, with five hours' contact much better results were achieved. With a dose of 1 in 1,600,000 B. coli was killed in about 84 per cent of the experiments, and even with half this dose nearly 40 per cent of the samples were sterilised.

It is apparent from the table that the potassium iodide and starch test has considerable limitations. Thus you frequently get a blue reaction in one hour without sterilisation in that time.

In five hours, absence of blue reaction does not necessarily imply non-sterilisation; even its presence may not afford absolute proof that sterilisation has taken place. Increase of temperature and presence of light tend to shorten greatly the period during which the blue reaction is obtainable, and this despite the fact that both these influences tend to accelerate the process of sterilisation under, at all events, laboratory conditions of experiment. This

* In conjunction with Dr. McGowan, who controlled the chemical part of the investigation. For further information, reference may be made to the Fifth Report of the Royal Commission on Sewage Disposal, Appendix IV.

† Chloros is an alkaline solution of sodium hypochlorite containing about 10-15 per cent of available chlorine. Bleaching powder (about 33 per cent available chlorine) is equally suitable, and is somewhat cheaper. On the other hand, the mixing of bleaching powder with water, so as to obtain a "bleach solution" of standard strength, is far from being an agreeable or easy task.

‡ The word "economically" is used purposely. Some may consider (rightly or wrongly) that it is not a good example to sterilise a supply, the purity of which is possibly open to criticism, and that the proper course to adopt is to seek a source of supply unimpeachable in quality. The writer does not propose to debate this aspect of the question.

§ At first parallel experiments were made with (*a*) shaken, (*b*) settled, and (*c*) paper-filtered samples of river water. It was found, however, that there was not much difference between the three sets of results, so these comparative experiments were stopped. All the recorded results refer to "shaken" (*i.e.*, "unsettled") samples of *raw* river water

being the case, it is obvious that too much reliance must not be placed on this test.

Some experiments (ten in number) were also carried out to see the effect of temperature on sterilisation in the dark. The temperatures chosen were 0 deg., 10 deg., and 20 deg. Cent. The doses were in each case 1 in 800,000, 1 in 1,600,000, 1 in 3,200,000, and 1 in 6,400,000, raw Thames river water being again used.

The bottles, with their contents, were first brought to the appropriate temperatures before the addition of the bleach solution.

BACTERIOLOGICAL RESULTS.—SIXTY-TWO SAMPLES.
(100 c.c. Cultures in each case.)

Period of contact.	Dose in terms of available chlorine.			
	1 in 800,000	1 in 1,600,000	1 in 3,200,000	1 in 6,400,000
Cols. 1	2	3	4	5
One hour	B. coli killed 47 out of 62 times (75·8 %)	B. coli killed 10 out of 62 times (16·1 %)	B. coli never killed (none %)	B. coli never killed (none %)
	Blue with KI and starch in all cases but one, which sample was not sterilised	Blue with KI and starch in 49 cases, the remaining 13 samples were not sterilised	Blue with KI and starch twice	No blue with KI and starch
Five hrs.	B. coli killed 58 out of 62 times (93·5 %)	B. coli killed 52 out of 62 times (83·9 %)	B. coli killed 24 out of 62 times (38·7 %)	B. coli killed 8 out of 62 times (12·9 %)
	Blue with KI and starch in all cases but three, yet these samples were sterilised. The two samples which were not sterilised gave a blue reaction	Blue with KI and starch in 42 cases. The 10 cases in which B. coli was not killed gave a blue reaction five times and no reaction five times	No blue with KI and starch	No blue with KI and starch

The results may be summarised briefly as follow:—

One hour's contact.

Comparison between 10 deg. Cent. and 0 deg. Cent.

Results the same six times.

Twice sterilisation occurred with a smaller dose at 10 deg. Cent. as compared with 0 deg. Cent.

Twice the converse held good.

Comparison between 20 deg. Cent. and 10 deg. Cent.

Results the same seven times.

Thrice sterilisation occurred with a smaller dose at 20 deg. Cent., as compared with 10 deg. Cent.

Comparison between 20 deg. Cent. and 0 deg. Cent.

Results the same five times.

Four times sterilisation occurred with a smaller dose at 20 deg. Cent., as compared with 0 deg. Cent.

Once the reverse occurred.

Five hours' contact.

Comparison between 10 deg. Cent. and 0 deg. Cent.

Results the same four times.

Six times sterilisation occurred with a smaller dose at 10 deg. Cent., as compared with 0 deg. Cent.

Comparison between 20 deg. Cent. and 10 deg. Cent.

Results the same four times.

Five times sterilisation occurred with a smaller dose at 20 deg. Cent., as compared with 10 deg. Cent.

Once the reverse occurred.

Comparison between 20 deg. Cent. and 0 deg. Cent.

Results the same three times.

Seven times sterilisation occurred with a smaller dose at 20 deg. Cent., as compared with 0 deg. Cent.

The safe, general conclusion seems to be that temperature has not any very marked action in one hour, but with five hours' contact the results, although not uniform, were decidedly in favour of the higher temperatures in effecting sterilisation—that is, under laboratory conditions of experiment.

Some experiments (twenty-two in number) were also carried out to see the effect of light on sterilisation. The same doses were used, one set of bottles (white glass and stoppered) being exposed to the influence of light and any sunshine available, and the other set being protected from light by placing them in a dark box. Both sets were placed on a flat roof. Raw Thames river water was again used. Details were kept as regards the number of hours of sunshine, temperature, &c., but as it is not proposed, for economy's sake, to deal with the individual results, these cannot be included. A few of the experiments were carried out at the end of January, but the great majority were done during March and April.

One hour's contact.

In thirteen cases there was no difference between the two sets of results.

In six cases sterilisation was effected with a smaller dose in the light as compared with darkness.

In three cases the reverse occurred.

Five hours' contact.

In thirteen cases there was no difference between the two sets of results.

In the remaining nine cases sterilisation took place with a smaller dose in the light as compared with darkness.

Under the conditions of experiment there would thus seem to be no doubt that light favours sterilisation, despite the fact that it was frequently noted that the blue reaction with potassium iodide and starch was less pronounced, or had disappeared altogether, in the samples exposed to the light in contrast to those kept in the dark. It does not, however, follow that the same results would be obtained under practical outdoor conditions.

The above results as regards sterilisation would not seem to have been due to the bactericidal effect of light, as the bottles containing the smaller doses of bleaching solution nearly always yielded positive results, and, indeed, served as "control" experiments.

I believe Rideal was the first to draw attention to a sterilising action extending considerably beyond the time when a blue reaction with potassium iodide and starch could still be detected. My own experience confirms the correctness of his views. The same observer advocates chiefly, I think, on theoretical grounds, the use of hypochlorites for removing the taste of algal infected water, and also as a substitute for copper sulphate for inhibiting the growth of algæ. As a matter of actual practical experience with London water, potassium permanganate, in doses of 2·5 to 5 lb. per 1,000,000 gallons, has been found to be much more effective in removing the taste from an algal infected water; indeed, with hypochlorites there is considerable danger of merely substituting one taste for another taste, or even introducing a superadded taste. Copper sulphate is a better algicidal than bactericidal agent, the converse being true of the hypochlorites. Nevertheless, hypochlorites, even in doses short of giving rise to a taste, have a considerable inhibitory power over the growth of algæ, although the good effects are usually of only a temporary character. For example—bottles containing river water, and hardly any algæ, have been purposely infected with a fractional amount of an algal infected water, and to some of them hypochlorites, in doses just about sufficient to kill B. coli, have been added as well. The bottles have then been placed on a flat roof exposed to light and examined from time to time. The "control" bottles (containing no hypochlorites) have nearly always suffered marked progressive algal deterioration, whereas the bottles containing hypochlorites have exhibited considerable resistance to deterioration for some considerable time, although usually the same algæ developed abundantly in them at a later stage. With permissible doses of hypochlorites it is apparently more a case of inhibition than of destruction.

Copper sulphate has, in my experience, exercised a more pronounced and more lasting effect than hypochlorites, the respective doses varying, but usually being about 0·5 part of copper sulphate, and 0·5 part of available chlorine per 1,000,000 parts of water.

The writer's first experience of the inhibitory action of hypochlorites on growths in water occurred at Lincoln in 1905, and subsequently. There were two open service reservoirs there which were fed with hypochlorite-treated water, and were themselves dosed with hypochlorites from time to time. Previous to 1905 they developed seasonally most abundant

growths, but during the hypochlorite treatment it was noticed that they remained bright, clear, and remarkably free from growths.

Reverting again to hypochlorite treatment, another series of sterilisation experiments (twenty-eight in number) were carried out with raw Thames river water, the period of contact being 7½, 15, 30, 60, and 300 minutes. The doses used, in terms of available chlorine, were 1 in 143,000, 1 in 1,334,000, 1 in 1,600,000, 1 in 2,000,000, 1 in 2,667,000, and 1 in 4,000,000.

Without going into detail, the results justify, so far as can be judged by laboratory experience, the following conclusions:

With 15, as compared with 7½ minutes' contact, smaller doses on the average are required for sterilisation purposes, but the differences are not very great, for the reason apparently that both periods are far too short for effective sterilisation with minimum doses.

Thirty minutes has a decided advantage over 15 minutes, and so has 60 minutes over 30 minutes, as regards sterilisation.

Again, the 300 minutes' results are so markedly better than the 60 minutes, that, wherever practicable, five hours' contact should be given.

The disadvantages of short contact are that wholly unnecessary doses of hypochlorite have to be used, and this entails not only waste, but provokes the possibility, or probability, of the water acquiring an objectionable taste.

OUTDOOR EXPERIMENTS.

After the work described had been undertaken, certain events of a serious nature arose in connection with the Water Board's supply of coal. Owing to the war the price of coal advanced not only to an unprecedented extent, but it became imperative, in the national interest, to reduce its consumption to the lowest practicable limit.

In these circumstances, the Staines chlorination experiments were started on May 1, 1916, and they have been continued without intermission up to the date of writing this report (October, 1916).

Started experimentally, the success of the treatment was so pronounced that it became an established waterworks procedure, but this does not necessarily bind the writer to the view that it should be continued indefinitely under post-war conditions.

It had been the custom to abstract 70,000,000 to 80,000,000 gallons daily of raw Thames water from the river at Bell Weir and to allow this water to pass down the Staines Aqueduct. At the Staines pumping station the water in the aqueduct was pumped up into the Staines reservoirs, and, after passing through these reservoirs, it was again allowed to enter the aqueduct, down which it flowed to supply the Sunbury, Kempton Park, Grand Junction (Hampton and Kew), and West Middlesex (by pumping) works.

The continuous pumping of so huge a volume of water into the reservoirs, for purposes of purification, obviously meant the expenditure of a very large sum of money on coal.

The retention of water in the Staines reservoirs was, of course, necessary for purposes of possible drought, but the waste, if waste it should be called, lay in the constant circulation of water through the reservoirs. The question thus arose whether it was feasible, and if feasible, desirable, to purify the water in the aqueduct and allow it to pass by gravity to the works concerned, thus avoiding the serious cost of pumping, while at the same time conserving water in store for emergency purposes.

It was decided to chlorinate experimentally, with the aid and co-operation of the engineering department, the raw river water in the aqueduct at Staines in such a way as to produce a water of as great, or greater, bacteriological purity than if stored Staines reservoir water had been in use.

The treatment to be successful had also to fulfil two main conditions. The treated water must not have any objectionable taste and be otherwise innocuous, and the amount of chloride of lime (bleaching powder) found necessary must in cost fall far short of the cost of coal required for pumping purposes.

It is desirable first to consider the bacteriological quality of the Thames before and after storage in the Staines reservoirs.

For the eighth-year period (1908-16) the raw Thames contained 440, and the Staines stored water 50 microbes per 10 c.c. (bile-salt agar test).

The raw Thames contained B. coli in 0·1 c.c. in 52·3 per cent (say 52) of the samples examined.

The Staines stored water contained B. coli in 100 c.c. in 79·8 per cent (say 80), and in 10 c.c. in 41·2 per cent (say 40) of the samples examined; 20·1 per cent (say 20) of the samples contained no B. coli in 100 c.c. and 58·7 (say 60), none in 10 c.c.

The standard to be at least equalled, and if possible excelled, in connection with the treatment was thus: The 100 c.c. cultures must not yield positive results in more than, say, 80 per cent of the samples examined—that is, at least 20 per cent of the results must be negative. The 10 c.c. cultures must not yield positive results in more than, say, 40 per cent of the samples examined—that is, at least 60 per cent of the results must be negative.

Alternatively, if the bile-salt agar test was employed, the number must be less than 50 per 10 c.c. in the treated water.

METHOD OF TREATMENT.

The following is a brief description of the method of treatment:—

The apparatus consists of two primary, or mixing tanks of about 150 gallons capacity, three secondary tanks of an available capacity of 900 gallons each, and two tertiary or balancing tanks, which are fitted with ball valves, and are capable of being fed from any of the secondary tanks.

Experience has shown that it is more convenient to work with an active chlorine liquor of variable strength discharged at a nearly constant rate, than with a liquor of constant strength discharged at a varying rate. Each of the three secondary tanks is therefore charged with liquor of such a strength that when emptied at the rate of 1½ gallons per minute (*i.e.*, 900 gallons in twelve hours) the requisite dose is given, the strength thus being determined by the dose and the flow of water in the aqueduct.

Each day enough liquor is prepared to fill two of the secondary tanks, the third being the supply tank while the other two are being charged. For example, if tank 3 is put into operation at 6 a.m., tanks 1 and 2 are in process of being filled; by 6 p.m., No. 1 becomes the supply tank until 6 a.m. the following morning, when No. 2 takes its place, and Nos. 3 and 1 are filled during the day.

The following method of preparing the liquor for the secondary tanks is employed:—

Each of the two primary tanks is fitted with an outlet in the side, so that when filled to a mark they will discharge exactly 75 gallons and still leave about 50 gallons below the outlet. The tanks are used alternately, and in each one-eighth part of the amount of chloride of lime required for the 900-gallon secondary tank is gradually mixed with water until the tank is full.

After the sediment has settled below the outlet, the clear liquor is run into the secondary tank. When this operation has been performed four times with each tank the tanks are twice filled up with water, without further addition of chloride of lime, and, after settling, the clear liquor run off into the secondary tanks as before, in order to wash out the lime remaining in the sludge below the outlet. There are thus 12×75=900 gallons of liquid run into the secondary tank. The whole is then well stirred up and the chlorine value of the liquor determined. The tank is then ready for use.

For example, let it be assumed that the dose is 1 in 2,000,000 in terms of available chlorine, that 75,000,000 gallons of water have to be treated in twenty-four hours, and that the chloride of lime will yield about 33 per cent available chlorine.

A dose of 1 in 2,000,000 is equivalent to 5 lb. of available chlorine per 1,000,000 gallons, so that the 75,000,000 gallons will require 5×75=375 lb. available chlorine; as the chloride of lime is assumed to yield 33 per cent, or one-third its weight of available chlorine, 375×3=1,125 lb. of chloride of lime will be required for the twenty-four hours, or half this amount, 562½ lb., for each twelve-hour tank. One-eighth part of this amount, say 70 lb., must be taken for each mixing.

Unfortunately, in practice, the strength of the chloride of lime varies considerably, so that it is necessary to determine the actual amount of available chlorine in the liquor when prepared, and finally adjust the dose by minor variations of the rate of discharge.

The active liquor is added to the raw river water flowing down the Staines aqueduct through a perforated submerged pipe traversing the channel, so as to ensure thorough mixing.

It is perhaps hardly necessary to add that the treatment could not have been carried out without the approval, active co-operation and help of the engineering department.

The treatment during May being largely experimental in character hardly needs consideration. The dose varied from 1 in 1,000,000 to 1 in 3,000,000, in terms of available chlorine. The results were sometimes unsatisfactory, at other times highly satisfactory, according to the conditions of the experiment, the dose employed, and other factors.

The information obtained, however, during the month was invaluable as a guide to the subsequent treatment. From June 1st onwards the dose was constant, and as nearly as possible 1 in 2,000,000, or 0·5 in 1,000,000 (=15 lb. of chloride of lime per 1,000,000 gallons of water). For about a fortnight it was temporarily increased by 25 per cent. for reasons which need not be considered here.

At first 70,000,000 to 80,000,000 gallons of water were treated at Staines, but from June 16th onwards about 50,000,000 gallons were treated there and about 30,000,000 gallons at Hampton, the latter water being abstracted at the West Middlesex "intake," and, after treatment by means of a separate plant, pumped to the reservoirs at Barnes and Barn Elms. The reason for this was that as the Thames falls during the summer and early autumn months, its level at Bell Weir does not always allow of 70,000,000 to 80,000,000

gallons being passed down the aqueduct by gravity alone.

The effect of the treatment at Hampton was judged by the collection of samples at Barnes as the water enters No. 3 reservoir.

As regards Staines, the site of collection up to August 18th was the aqueduct just above the Sunbury intake. From August 19th onwards it was changed to a spot just above the cross roads opposite Littleton Common, about 3 miles below Staines pumping station. The change arose from the fact that it was observed that the Hampton treatment was giving the better results, although the dose was the same. This led to the discovery that the Staines water deteriorated in quality as it passed down the aqueduct, particularly below the spot just mentioned. As the active part of the chlorinating liquor is lost soon after leaving Staines, any fresh polluting material occurring lower down would be unaffected by the treatment. The aqueduct is an open one, and necessarily exposed to risks of contamination, which, if unimportant practically, were sufficient to affect the results of the treatment, in view of the extreme delicacy of the tests employed and the high standards sought to be attained. Moreover, especially lower down, fish are present in enormous numbers in the aqueduct, and their excretions undoubtedly contain lactose fermenting coli-like microbes. The mere presence of the fish is *per se* evidence of the innocuous character of the treatment. In what follows then it needs to be remembered that the results, good as they were, would undoubtedly have been much better if the aqueduct had been a closed impervious channel, free from fish and other forms of life.

The results obtained may now be considered.

HAMPTON — WEST MIDDLESEX RESULTS.

From June 19th to September 30th, seventy-five samples were collected and ten 10 c.c. cultures made from each sample.

The results were as follows:—

Only 3 per cent of the samples yielded positive results as compared with the Staines stored standard of 40 per cent.

Or, putting it the converse way, the treated water yielded 97 per cent of negative results as compared with the 60 per cent standard.

The results were thus far better than if Staines water had been used for supply purposes.

In addition twenty-six samples were examined by the bile-salt agar test.

The number of microbes per 10 c.c. of water was seven, as compared with 50 per 10 c.c. of Staines stored water (eight years' average result).

Twenty-five samples were also examined by means of the 100 c.c. B. coli test. Only 24 per cent of the samples yielded positive results, as compared with 80 per cent (Staines stored standard). This is the same as saying that 76 per cent yielded negative results, as compared with the standard of 20 per cent.

STAINES AFFECTING THE SUNBURY, KEMPTON PARK AND GRAND JUNCTION WORKS) RESULTS.

From June 1st to August 18th (both inclusive), 395 samples were examined by the 100 c.c. B. coli test.

Only 61 per cent of the samples yielded positive results, as compared with 80 per cent (Staines stored standard). This is the same as saying that 39 per cent yielded negative results, as compared with the standard of 20 per cent.

Seventy-nine samples were also examined by the 10 c.c. B. coli test, ten cultures of 10 c.c. being made from each sample.

Fourteen per cent yielded positive results, as compared with 40 per cent (Staines stored standard).

Thus the treated water yielded negative results in 86 per cent, as compared with the 60 per cent (Staines stored standard).

These results would beyond doubt have been even more satisfactory if the fresh pollutions along the line of the aqueduct could have been eliminated.

From August 19th (when the site of collection was changed) to the end of September the results were still more favourable—namely, as follows:—

100 c.c. B. coli Test.—Only 31 per cent yielded positive results (69 per cent negative). The additional number of samples examined was 215.

10 c.c. B. coli Test.—Only 1 per cent yielded positive results (99 per cent negative). The additional number of samples examined was forty-three.

In addition, thirty-seven samples were examined by the bile-salt agar test. The number of microbes per 10 c.c. was *nil*, as compared with 50 per 10 c.c. of Staines stored water (eight years' average results).

It is obvious from the foregoing that the treatment was a great success bacteriologically, although the water was not always completely sterilised.

It would have been quite possible in the case of the Hampton treatment to have had all the results negative (*i.e.*, sterile), but this would have necessitated the use of somewhat larger doses of chloride of lime, and this was not thought desirable in all the circumstances. As regards Staines, an increased dose might have produced no difference, owing to fresh contamination taking place *en route*.

The accompanying table sets forth the results quite clearly:—

Description.	100 c.c. cultures B. coli test.		10 c.c. cultures B. coli test.		Bilesalt agar test, microbes per 10 c.c.
Col. 1	% positive. 2	% negative. 3	% positive. 4	% negative 5	6
Staines stored water standard, eight years average	80	20	40	60	50
Hampton treatment June 19th to Sept. 30th (both inclusive)	24	76*	3	97	7*
Staines treatment period June 1st to Aug 18th (both inclusive). First place of collection	61	39	14	86	Only a few samples examined
Staines treatment Aug 19th to Sept 30th (both inclusive). Second place of collection	31	69	1	99	*None in 10 c.c.

	1 c.c. cultures B. coli test.		0·1 c.c. cultures B. coli test.		
	% positive.	% negative.	% positive.	% negative	
Raw Thames river water for comparative purposes, eight years' average	89	11	52	48	440

Not all the samples were examined by these tests, but a sufficient number to allow of firm conclusions being drawn.

The dose throughout was 0·5 part per 1,000,000 parts in terms of available chlorine (=15 lb. of chloride of lime per 1,000,000 gallons of water), except for about a fortnight (Staines part of treatment), when it was temporarily increased 25 per cent.

The table is self-explanatory, but those who dislike percentage B. coli results may refer with advantage to the numerical figures given in column 6. The bile-salt agar test is reputedly a measure of the number of excremental microbes in a water. It will be noted that by storage 440 microbes (raw water) can be reduced to 50 (stored water). Hypochlorite treatment can do better than this, the number being only seven (Hampton treatment) and *nil* (Staines treatment).

As regards taste, some members of my staff can detect a taste which would be quite inappreciable to the general public. The water never tasted, nor was a single complaint received from the consumers of the treated water (over 2,000,000 individuals).

It should be mentioned that the treatment was carried out under the closest supervision. Multiple samples were examined and numerous tests applied, and highly experienced members of my staff had special duties entrusted to them in this connection. It is true that the experiment was on a huge scale, but the precautions taken to safeguard the interests of water consumers were correspondingly stringent.

COSTS.

In respect of cost, less labour is required for chlorination than for pumping. With a dose of 0·5 part of available chlorine per 1,000,000 parts of water (or 15 lb. of chloride of lime of 33 per cent strength per 1,000,000 gallons) the war cost of the material would be about 3s.* The war cost of coal to pump 1,000,000 gallons would be about 13s. The saving per day on, say, 75,000,000 gallons would thus be £37 10s.

* As time went on the quality of the consignments of chloride of lime fell off considerably, owing, apparently, to the Government having first call on all the available stocks. As no rebate could be obtained, the above figure is somewhat low.

(£262 10s. per week). The interest on the capital charges of the installation is almost negligible, but even if it were decided to wipe out the capital charge altogether the money saved by one or two weeks' treatment would suffice for this purpose. Perhaps the round sum of £200 saved per week would be the safest figure to take, and this would far more than cover all incidental expenses.

On the other hand, it must be remembered that sand filters usually last longer without cleaning when stored water is used for filtration purposes in place of raw river water.

This, however, is only true when the stored water does not deteriorate owing to algal troubles. Last year it will be remembered that the Staines aqueduct was fed with Staines stored water, plus a variable amount of raw river water, which had to be added owing to the presence of algal growths in the Staines water. This year, of course, the aqueduct received Thames "treated" water, and it is of interest to compare the laboratory filtration results in the two cases together with some of the reservoir results.

Number of c.c. filtered per minute through the skin derived from the suspended matter in 100 c.c. of water. The *larger* the number, the *better* the result. Averages for June, July, August and September (inclusive).

		1915.	1916.
(*a*)	Staines Aqueduct	98	203
(*b*)	Grand Junction (Hampton) reservoir water	120	252
(*c*)	,, ,, (Kew) ,, ,,	112	276
(*d*)	East London (Sunbury) ,, ,,	119	258
(*e*)	West Middlesex, No. 1 ,, ,,	112	193
(*f*)	,, ,, No. 2 ,, ,,	62	223
(*g*)	,, ,, No. 4 ,, ,,	58	117
(*h*)	,, ,, No. 6 ,, ,,	59	137

(*a*) feeds (*b*) to (*h*) reservoirs under normal conditions. From June 19 to September 30, 1916, (*c*) to (*h*) reservoirs were supplied with treated Thames water from Hampton. The Kempton Park works can be supplied either direct from (*a*) or indirectly after passing through the Kempton Park reservoirs.

So far, then, as can be judged by laboratory results, it is considerably better from the filtration point of view to feed the Staines aqueduct with "treated" river water than with stored river water. At the same time, it is worth noting that the West Middlesex reservoirs, heavily "seeded" with past algal growths, suffered again to some extent from fresh developmental changes, although fed with hypochlorite treated water. Nevertheless, the conditions never became at all serious, as in previous years. The conclusion seems to be that, even if you kill the growths in a water "feeding" a reservoir, development may still occur in the water in the reservoir from the seeds (so to speak) of past visitations. It follows, apparently, that, within certain limits, short rather than prolonged storage is better in the case of a hypochlorite-treated water. It is noteworthy that the East London (Sunbury) and Grand Junction (Hampton and Kew) reservoir results were very good, due, no doubt, to the fact that these reservoirs are of a relatively small capacity. On the other hand, the storage should be sufficient to allow of satisfactory settlement of the amorphous suspended matters in the treated water.

PRACTICAL EXPERIENCE.

Turning next to practical experience, the filtration returns for June, July, August and September of 1916 compare most favourably with a similar period of last year.

Thus the percentage reduction in acres of filter beds cleaned in 1916 (June to September), as compared with 1915, works out as follows:—

	Percentage reduction (approximate).
Grand Junction (Hampton)	6*
,, ,, (Kew)	14
Kempton Park	33†
East London (Sunbury)	23
West Middlesex	50

These results are most gratifying, but, of course, the season of the year must be borne in mind, and similar results can hardly be expected during the winter months, when the river water becomes heavily charged with suspended matter.

A comparison between the chemical (permanganate test) and bacteriological (B. coli test) results of this year and last year (June to September) as regards the East London (Sunbury), Kempton Park, Grand Junction and West Middlesex works is distinctly in favour of the chemical treatment. During the winter months of the year, however, the chemical results, at all events, may be expected to compare unfavourably with the comparable period of last year.

It would not have been justifiable to have carried out the treatment in order to save money if it had involved the slightest risk of injury to the consumer. This, however, is far from being the case, the treated water being purer, bacteriologically, than Staines stored water, and in all other respects quite innocuous.

It may be said that the addition of chemicals to London water is a retrograde step. In times of great prosperity this view would (rightly or wrongly) have many advocates. Under war conditions sentiment ought to give way to expediency. It needs to be remembered that the gain has been a double one. In the first place, a large sum of money has been saved without any detriment to health; and, secondly, the national interests have been served by reducing largely the consumption of coal.

It may be asked, How will it be practicable to continue the treatment during the winter months when the river is in flood? The answer is that it may be found possible to alternate the use of treated water and stored water in such a way as to overcome all difficulties. In any case, the objects of the treatment will still remain the same—namely, to economise in the consumption of coal, subject always to safeguarding adequately the safety of the supply.

Another question that arises is the effect of allowing water to stagnate in the Staines reservoirs during the continuance of the treatment. The main point is that water can never deteriorate epidemiologically under these conditions. On the contrary, the longer the water is held in store, the more certain is the elimination of the pathogenic bacteria causing water-borne disease. On the other hand, stagnation may provoke the excessive development of algal and other growths, which, although innocuous, may interfere mechanically with filtration, and may even give rise to taste troubles. Conceivably, during the period of stagnation, there may be recurrent phases of deterioration and improvement, and should this occur there is always the hope that the water will only be required during the latter stage. All this, however, is problematical, whereas the epidemiological gain is certain. Thus, putting speculative algal troubles on one side, there is a double gain. The treated water is safer than the normally stored water, and the water stored for an abnormally long time as a result of the treatment becomes safer than when stored for the usual period.

RESULT OF TREATMENT.

In conclusion, the result of the treatment has been briefly as follows:—

The sand filters at the East London (Sunbury), Kempton Park, Grand Junction (Hampton and Kew) and West Middlesex works have received a purer water, bacteriologically, than is customary, and they have lasted longer without cleaning.

The filtered water from these works, as pumped to the consumers, has been even safer, as judged by the tests employed, than is usual, and free from any smell, taste, or noxious ingredient.

On a conservative basis the saving in cost has exceeded £200 per week, or £3,400 for the period here dealt with (June to September).

An opportunity presented itself of testing elsewhere a sterilisation plant working with liquid chlorine. The water being dealt with was pumped under pressure through a sand filter, working apparently at the high rate of 65 gallons per square foot per hour. It was then treated with chlorine in a closed vessel, the period of contact being stated to be only twelve minutes. The chlorine gas from the liquid chlorine, contained in a metal cylinder, was passed through an ingenious contrivance which maintained a constant gas pressure. The gas passed out of the apparatus through a minute orifice, and a manometer registered the dose. By a throttling device the dose could, within certain limits, be varied at will, the current dose being indicated on the specially calibrated scale of the manometer. The difference between the dose as determined by manometer readings and the dose as judged by gravimetric determinations of the loss of weight of the cylinder during trial "runs," is said never to exceed 3 per cent.

The gas escaping from the above apparatus passed along a pipe to a porous diffuser contained in the water to be treated.

(*a*) The raw water contained 120 experimental microbes per c.c. (bile-salt agar test).

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* Grand Junction (Hampton) appears to have benefited by the change of water to a much less extent than Grand Junction (Kew).

† Less water, however, was filtered at the Kempton Park works in 1916.

(6) It yielded positive B. coli results with 0·1 c.c. liquid lactose peptone bilesalt medium.

The oxygen absorbed (5 mins at 80 deg. Fahr.) figure was 0·319 parts per 100,000.

After passing through the pressure filter the results for tests on 0·5, 1·0 and 1·50, 0·1 c.c. 0·291 respectively.

Four series of experiments were carried out, the selected dose of effluent being 0·5, 1·0, 2·0, and 3·0 parts per 1,000,000 parts of water. Three 100 c.c. cultures were made on the spot, at five-minute intervals for each of the above doses (twelve cultures in all), and at the same time twelve duplicate sterile bottles were completely filled with the effluent water with the object of testing their contents after the lapse of five hours.

It has been stated that one of the advantages of the use of liquid chlorine for sterilisation purposes is that the sterilising action is practically instantaneous. The results of the experiment do not support this contention, for it was found that all the twelve cultures made on the spot (*i.e.*, after twelve minutes' contact) yielded positive B. coli results, with the exception of one of them belonging to the maximum dose, whereas the duplicate samples, after being bottled up for five hours, all gave negative results, with the exception of one of the bottles pertaining to the minimum dose of 0·5 part per 1,000,000 parts.

Assuming the doses to be really as stated, the results seem to indicate that an impure water can be sterilised with a dose of about 0·5 to 1·0 part per 1,000,000 parts in five hours. A dose, however, of as much as 3 parts per 1,000,000 parts was ineffective two out of three cultures with only twelve minutes' contact.

RESURFACING MACADAM ROADS WITH SMALL BRICK CUBES.

Some years ago Mr. J. Y. McClintock, county engineer of Monroe County, New York, devised a new type of road in which 2-in. cubes of concrete laid on a sand or stone bed formed the wearing surface. Some of these stretches of road have been in service for five or six years, but they have not proved entirely successful, mainly, it is thought, because of the lack of strength or toughness in the concrete itself. The individual blocks have broken or become edge-worn, so that it has been necessary to replace them or to cover with an asphalt or tar coating.

About the same time, however, experiments were made with similar small cubes made of clay, and these (states *Engineering News*) have worn much more satisfactorily, so much so in fact that Mr. McClintock is favourably inclined to use them extensively in re-surfacing worn macadam roads. This season he has covered an experimental stretch with apparent success, although the test of time has not yet been applied.

The blocks used are 2¼-in. cubes of vitrified clay, each weighing about 1 lb. In resurfacing the road the old worn top is brought up to a smooth crown with sand and then rolled. On this surface the cubes are placed by hand, covered with a light coating of sand, and the whole rolled to make the finished road. So far no joint binder has been used.

In placing the cubes they are first laid out on a pallet—work that can be done by a boy. The filled pallet is then put down on the rolled surface and slid from under the cubes, leaving them in place except for simple tapping with a hammer.

The advantages claimed for the method are its cheapness, the ease with which local labour can be used, and the readiness with which repairs can be made. If blocks wear down or break, they can be replaced by picking out and setting others in place. It is claimed that the road has a desirable resiliency also. It resembles in surface an ordinary brick road.

In Monroe County, experiments were also made with local clay, which cannot be vitrified, and some sections of road with 2-in. cubes of this material were tried. It was found, however, that they were not tough enough to stand up under traffic.

Business Announcement.—As letters and samples still continue to be sent to their old premises, Mr. D. B. Butler, the principal, asks us to state that the address of the Portland Cement Testing Works and Chemical Laboratories is now 6 Earl-street, Westminster, S.W.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Can the action of the Northampton Town Council be called altogether patriotic when, at a recent meeting, in spite of protest, they agreed to charge a rent of £1 5s. a week to the military authorities for the use of the Grand Stand on the racecourse as a hospital for wounded soldiers? If this council really represent the wishes of the ratepayers, does it not seem almost incredible that they should so little appreciate what we owe to the men who are fighting for us?

* * * *

Is it not significant of the popularity of brick roads in the United States when a pamphlet of some forty pages dealing with their construction is issued by the Government highways department of that country? But although such pavements may be of practical value in America, are they of any use in this country where other and apparently better materials are available? Can we not, however, gain considerable knowledge from studying what is being done in other countries with regard to this important question of the construction of good roads?

* * * *

Will the Thames estuary become so pure that some day salmon will return to it? Is there not now a gleam of hope in this direction when we read in a Surrey contemporary that lamperns, or "nine eyes," fish that have the same habit as the salmon, have recently been taken at Teddington? In view of the statement of the writer of the article that, "should the present run of lamperns have made the journey from the ocean, their presence at Teddington is further testimony to the increasing purity of the water below London Bridge," is there not a possibility that we may go back to the time when salmon were so plentiful in the Thames that apprentices used to object to having to eat it more than twice a week?

* * * *

Is not the American proposal to construct reinforced concrete streets with a large hollow space underneath extending from building to building rather a novel one? Would it not settle the question of subways under streets for gas and water pipes, electric cables, and so forth, if such streets could be constructed, and is there any engineering difficulty which stands in the way of such a system of construction?

* * * *

Why is it that huts for soldiers, or temporary offices for the Government, are not constructed in the open space in Trafalgar-square, which appears to be most suitable for the purpose? Is it because this ground is sacred to the spouter and agitator, and is considered to be more valuable in times of war for this purpose than as a means of finding shelter for our soldiers?

* * * *

Will there not some day be a boom in house refuse when we see how many people are now urging that there is money to be made out of the dustbin? Are there not individuals and companies now "on the warpath" in connection with the utilisation of this waste product, either as fuel or manure, and by the recovery from it of valuable metals, bottles, glass, paper, &c.? Will the Government, however, be wise enough to let companies be formed for the purpose during the war, or will it be left to German financiers to step in after the war and make their pile?

* * * *

Do we not often read of surprising events which occur in America? Is there not a case in point in the report of an experience of Mr. Andrew F. Macallum, the Water Commissioner of Ottawa, of an asphalt concrete pavement of 1 in 21, on which, he says, the wagons generally came down first dragging the horses after them? Was not this putting the cart before the horse in a very decided fashion?

* * * *

Is it quite fair of the writer of a letter in the correspondence columns of a contemporary to suggest that the large number of surveyors who are now seeking commissions in the new Roadmakers' Corps should have offered themselves before, for military service, if of military age? Is it not more than possible that most of those applicants are beyond the military age, or have already applied and have been disqualified for various reasons?

Clinker Mexphalte Roads and Disposal of Refuse Destructor Clinker at Abertillery.

By LIONEL D. LEWIS, Engineer and Surveyor to the Abertillery Urban District Council.

With the universal cry for economy the [illegible] danger of a municipal engineer being taken along with the current of public opinion, and so ruthlessly cutting down his estimates as to result, in the near future, in only bringing about a much greater expenditure in order to make good the inevitable outcome of adopting so short-sighted a policy. In no branch of municipal work is this more evidenced to-day than in road maintenance. It is easy to trace the policy of the authority which, after the outbreak of war, substantially reduced its expenditure on roads, and which by to-day cannot, if so desired, expend the additional money necessary to arrest the disastrous effects, owing to the great shortage of labour.

The true economy to be practised by any profession responsible for the spending of the national wealth is the one that will not sacrifice efficiency, for the future of this country will demand even better and more modern equipment in all branches.

With the great volume of traffic which is being diverted from the railways to our roads, with the impetus given by the development of the steam, petrol and electric motor vehicle, I begin to wonder how we are going to reconcile this state of affairs with reduction of expenditure and consequent starving of roads.

It seems to me that the only hope of success in the future lies in our being prepared to drop our old methods and prejudices, and see what can be done in the direction of modernising our ways and ideas, which revision will possibly result in awakening us to our local resources and, at the same time, afford the desired financial relief.

Having successfully used destructor clinker for several purposes in road and street work, I was attracted by the very striking results obtained through the use of clinker Mexphalte by that most successful of municipal engineers, Mr. Lovegrove, of Hornsey. From what I saw during an inspection of his roads I determined to follow his example, and as surveyor of one of the first districts to carry out the process I am anxious to point out the results of our work.

At Abertillery I decided to lay down several sections of the main road through the district with a single coat or carpet of clinker Mexphalte, 1½ in. thick when consolidated, and also to surface a street, over which all the goods traffic of the district passes, it being the only approach to the railway company's goods yard.

The roads treated are as follows:—

Oak-street, Abertillery: 1,485 super. yds., with a carriageway 16 ft. 10 in. wide, carrying an average of 654 tons of traffic per day, on motor lorries and horse wagons, from the railway company's goods station.

*Bridge-street, Six Bells: 798 super. yds.; width of carriageway, 20 ft. 4 in.

*Aberbeeg-road: 2,153 super. yds.; width of carriageway 19 ft. 2 in.

*Llanhilleth-road: 1,970 super. yds.; width of carriageway, 17 ft. 4 in.

These roads were laid down between July and September, and are giving excellent results. The Oak-street test is a very striking testimony to the success of the process, for, owing to the very hilly nature of the district, the heavy lorry horses have shoes with large caulks to give them a foothold, and it was found that in the hot weather the surface of the road was marked in consequence, but the impressions disappeared by the following morning. I might also state that the use of frost nails has in no way damaged the surface of the road.

The outstanding advantages of clinker Mexphalte are:—

(1) A definite and profitable use for your refuse destructor clinker, 80 per cent to 85 per cent being used in the process.

(2) The provision of a first-class road surface, the cost being at least not higher than tar-macadam.

(3) Carpeting 1½ in. thick covers 16 super. yds. per ton, as against 6 yds. per ton for a full coat of tar-macadam.

(4) The annual cost of tar-painting is saved.

(5) The carpeting can be laid on an old macadam-surfaced road, and any depressions made up with a coarser clinker Mexphalte binder.

*These are different sections of the main district road carrying a through traffic of 548 tons per day.

To me the most striking feature is that, at a greatly reduced cost, we are providing a road more likely to withstand the wear and tear of vehicular traffic. To illustrate what I mean I can only liken the present method of laying expensive concrete foundations to roads to the action of a cricketer who, being about to take a catch, holds his hands as rigidly as possible, instead of taking the ball while withdrawing them and thus minimising the force of the compact.

Proof of this is to be found on examination of the shattered state of the concrete road foundations, which condition indicates to me the need of a more springy road, that, although built on a much lighter and less costly specification, wears better owing to the amount of resilience in receiving the pounding of heavy vehicles.

During the summer I was particularly struck with the resilient properties of the clinker Mexphalte, and believe that time will reveal that this type of road will be found to outlast the more costly methods of road construction adopted to withstand heavy traffic.

I am not suggesting that the methods of the manufacture and laying of this material can be adopted at random, for these matters call for careful consideration and forethought. I believe that bituminous roads would be in a more advanced state in this country to-day if it were fully realised that the manufacture and treatment must, of necessity, involve some little technical study. It is not for me, in this article, to go into details as to the practice to follow, but I would strongly advise any engineer who wants a profitable outlet for his destructor clinker, and intends to take up this work, to act strictly on the instructions of the patentee and licensees of the process, for success depends upon working to a definite specification, arrived at after laboratorial tests of the clinker, which naturally varies in each town.

The Highways Construction Company, who are the licensees of the process under the patented rights of Mr. Lovegrove, acted as advisers to my council, who were granted a sub-licence. By this arrangement the council were enabled to utilise their own workmen, both in the laying of the material and its manufacture at the destructor. Having an abundance of steam and engine power at the destructor, the grinding, screening, and mixing plants were provided by the Highways Construction Company, and the council erected a permanent dryer.

The Highways Construction Company were represented in the district by Mr. A. W. Keep as supervisor, with a skilled spreader on the roads, and a practical manufacturer at the destructor under the direction of Mr. Lovatt, the manager of the company, who set the specification and provided the laboratorial check on the material. My authority is very pleased with the work, and I am now taking steps to purchase machinery in readiness for next season, when I hope to manufacture the material ourselves and continue the work.

At a later date I intend to submit some photographs of the roads treated, together with additional information.

In conclusion, I may add that as a proof of the uses to which destructor clinker can be put, I have now in Oak-street, previously referred to, a thoroughfare made up entirely of clinker products—viz.:—

Kerbing of clinker concrete.

Footpaths of clinker paving flags and tarred clinker respectively.

Carriageway of clinker Mexphalte, no channel stones being required, as the carpet is laid right up to the kerb.

Junior Institution of Engineers.—Mr. F. W. Lanchester, M.Inst.C.E., will deliver his presidential address on Monday next at the Lecture Hall of the Institution of Electrical Engineers, Victoria-embankment. The retiring president, Hon. the Marquis of Graham, will take the chair at 8 p.m.; will present the institution awards, for the thirty-fifth session, to London recipients; will present the retiring secretary, Mr. A. Clifford Swales, with a cheque as first portion of the Testimonial Fund now being subscribed in appreciation of his past services; and will induct his successor into the presidential chair.

The Surveyor
And Municipal and County Engineer

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CORRESPONDENCE.

Ἐκ ἀνηρ οὐ παθ' ὁρᾶ

(One man does not see everything.)

—EURIPIDES.

CONCRETE ROADS.

To the Editor of THE SURVEYOR.

SIR,—I have read with much interest the notes and correspondence regarding concrete roads which have recently appeared in your journal. Having had considerable experience of this class of road over a lengthy period, I would just urge a word of caution in regard to concrete roads, especially those subjected to heavy traffic.

A portion of a road carrying heavy traffic was selected for testing purposes seven years ago. It was laid with concrete in a most careful and substantial manner, and remained in good condition for about four years. The surface then began to show signs of wear, and, in the course of the following year, it became badly corrugated, and patching had to be resorted to. This is an expensive process, as traffic must be kept off for ten to fourteen days to allow the cement time to harden properly. The watching of a small patch, therefore, adds very materially to the cost of repair, and, in addition, the traffic is put to some inconvenience.

It is impossible to avoid the breaking up of public streets from time to time in order to repair, alter or renew drains, water and gas pipes, &c., and each time this is done the process of watching has to be renewed while the cement patch hardens over the reinstatement. Where the reinstatement is not carried out by the council's employees it will probably be necessary to keep an inspector on the work to see that the cement as restored is as good as that taken up. This means further expense, and the joints left are sure to be a source of weakness. Granite sett paving was laid alongside the stretch of concrete I refer to, and it is likely to have a life at least four times that of the concrete.

I have also laid many streets with concrete where the traffic is light, and these have remained in excellent order after twelve years' wear, and are not likely to require renewal for at least another twelve years. Any openings for pipe repairs, however, have proved just as expensive to repair as in the case of the heavy-trafficked road.

Concrete is an excellent paving material in many respects, but after long and careful trial I have abandoned its use in favour of tar-macadam, which costs about the same and is easily repaired. Until the difficulty in repairing can be got over I do not think that concrete will be largely adopted for street paving, and it certainly will not satisfactorily stand heavy traffic.—Yours, &c.,

CONCRETOR.

December 5, 1916.

REGULATION OF PEDESTRIAN TRAFFIC.

To the Editor of THE SURVEYOR.

SIR,—I regret that I do not agree with the writer of "Things One Would Like to Know," in the suggestion he makes in your last issue that the police regulations as to pedestrians keeping "to the right" should be altered to read "to the left."

I have to offer a simple solution of 75 per cent of the difficulties of darkened streets which I venture to think is well worth a trial.

It merely involves a small extension of the pedestrian's present rule of the road, "keep to the right," and my suggestion of this rule as extended is as follows—viz.

Keep to the right and the right-hand footway of whatever street you are walking in.

Put shortly, it might read thus, "walk on the right-hand footway." Some advantages would be as follows:

(1) You have always a means of guidance in the wall or railing immediately on your right.

(2) You avoid all lamp-posts, tramway standards, pillar-boxes, section boxes, letter boxes, and other obstructions set on the edge of the kerb.

(3) The stream of pedestrian traffic being in all one direction on each footway, any chance of collision with pedestrians proceeding in the opposite direction is impossible.

(4) An "up line" and a "down line" is provided for all pedestrian traffic in place of the present higgledy-piggledy arrangement.

(5) You may select your own time to pass on the outer or left side any slower-going pedestrians in front of you instead of having, as at present, to dodge opposing traffic at the exact moment of meeting it.

(6) The proposal is absolutely effective for all through-going traffic, but a certain allowance must be made for short-distance traffic, such as in making calls, shopping, &c., at points in close proximity to each other on the same side of the street, but as shops are now closed early this latter objection is not serious.

I can adduce other advantages, but have already given sufficient to prove the utility of the idea.

Authorities should, in my opinion, be urged to adopt this simple expedient, and put it in force after nightfall without delay.—Yours, &c.,

ABERDON.

December 4 1916.

MUNICIPAL SCHEMES AFTER THE WAR.

BEDWELLTY U.D.C.—It has been agreed that the erection of a viaduct from Bargoed to Aberbargoed should be included in the list of works to be carried out after the war, and that a sum of £50,000 be assigned as the council's proportion of the cost.

HULL T.C.—The post-war schemes include the construction of a new road from Spring Bank West to Springhead and Willerby; a new road from Chanterlands-avenue to Cottingham-road; the widening of Hessle-road and Hedon-road; and schemes of road repair in wood and macadam.

Bell Filters at Macclesfield.—The inauguration took place recently of new mechanical filters which have been installed at the Macclesfield Corporation waterworks by Messrs. Bell Brothers, Ravensthorpe, Yorks. The plant, which has been erected under the supervision of Mr. S. C. Baggott, the borough surveyor and water engineer, consists of a battery of four filters, each 8 ft. in diameter by 6 ft. high. Each filter is capable of filtering 6,250 gallons per hour, thus giving a total filtering capacity of 600,000 gallons per twenty-four hours. Bell filters have been installed in many towns, including Bolton (two), Dunoon, in Scotland (four), Edinburgh, Gloucester, Huddersfield, Shrewsbury, Sheffield, Buxton, and Stockport. The installation at the last named place is one of the latest, and is fitted at the new Kinderscout waterworks. The battery of filters there is filtering 1,500,000 gallons per day.

Sanitation with the British Expeditionary Force in France.*

By N. W. HOSKINS.

There is no doubt that before this war the question of sanitary arrangements for an army in the field had been very much neglected.

It is a fact not generally known that in former campaigns the number of men who have died from disease has greatly exceeded the number who have died as a result of the enemy's wounds. During a period of the South African War we lost in deaths from wounds 6,965 N.C.O.'s and men, whereas 13,590 died from disease and 72,551 were invalided back to

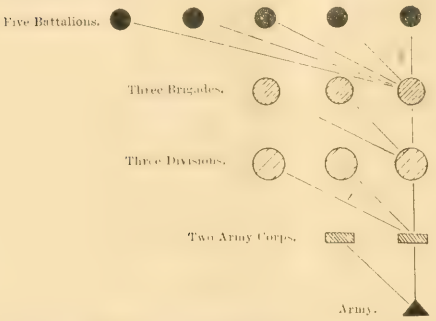

FIG. 1. SANITARY ORGANISATION OF AN ARMY IN THE FIELD.

England. For every soldier admitted to hospital for wounds, seventeen were admitted for disease.

In times of peace, when the sanitary arrangements for barracks and camps are in the hands of contractors, there is little need for more than the regimental sanitary fatigue men, and it was not until we had sent an Expeditionary Force to France and conditions became abnormal that the true value of qualified sanitary men became apparent.

Before going into the details of sanitary work

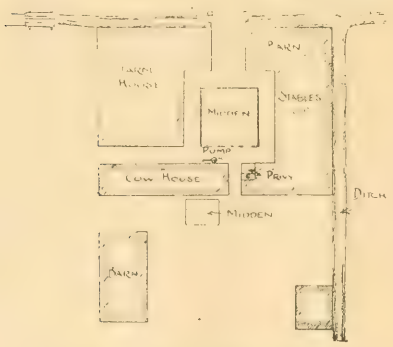

FIG. 2. PLAN OF TYPICAL FARMHOUSE.

carried out in France, it will not be out of place if I describe the sanitary organisation of an army in the field. (Fig. 1.)

The Field Service Regulations state that "the commander of every unit or formation is responsible for the sanitary condition of the quarters or localities occupied by his command and for taking all measures necessary for the preservation of the health of those men under him. He is also responsible for seeing that each officer and soldier observes all sanitary orders and for the good order and cleanliness of that portion of a quarter or locality under his charge, irrespective of the period for which it may be occupied."

* Paper read on Wednesday evening at a meeting of the Institution of Sanitary Engineers

In practice it is the Medical Officer of the unit who is in charge of the sanitary arrangements and is responsible to the Commanding Officer.

At the head of the medical staff of a division is the Assistant Director of Medical Services (A.D.M.S.). There is a Deputy Assistant Director of Medical Services (D.A.D.M.S.), Divisional Sanitary Officer and Sanitary Section, consisting of twenty-five N.C.O.'s and men. It is this section that carries out the supervisory and skilled sanitary work for the division. These sections consist of specially enlisted men with sanitary qualifications and experience. Attached to these sections are divisional fatigue squads of men who, owing to some physical defect, are unfit for work in the trenches.

Each battalion in the division has a Medical Officer (M.O.), who has under him for sanitary duties one N.C.O. and eight men, and for water duties one N.C.O. and four men.

At this point I might mention that the methods of sanitation given in this paper are those recommended and carried out by a Divisional Sanitary Section (O.C., Captain F. S. Carson, M.B., D.P.H.OXON., R.A.M.C.T.).

BILLETS.

The billets occupied by the troops in France consist of schools, factories and private houses in town areas, and barns, farm buildings and huts in the country districts. During the hot weather the men

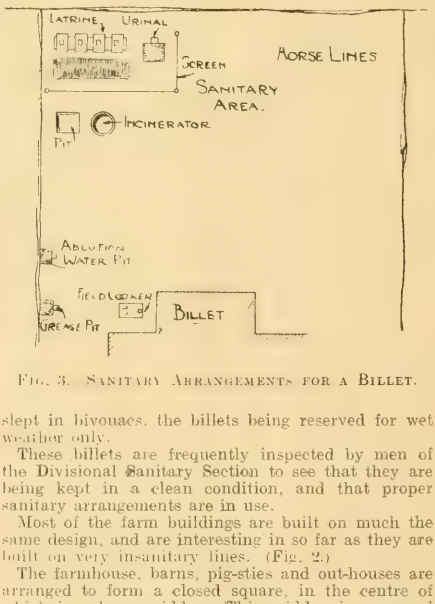

FIG. 3. SANITARY ARRANGEMENTS FOR A BILLET.

slept in bivouacs, the billets being reserved for wet weather only.

These billets are frequently inspected by men of the Divisional Sanitary Section to see that they are being kept in a clean condition, and that proper sanitary arrangements are in use.

Most of the farm buildings are built on much the same design, and are interesting in so far as they are built on very insanitary lines. (Fig. 2.)

The farmhouse, barns, pig-sties and out-houses are arranged to form a closed square, in the centre of which is a large midden. This midden is supposed to be watertight, and is full of manure, straw and foul water. All civilian slop and sullage water is run into this, and the whole thing is emptied once a year and ploughed into the land.

The privy, which consists of a wooden-box seat over a brick pit, is situated in one corner of the square, and is emptied periodically, the contents being spread over the garden land adjoining the house. The pump from a shallow well is within a few feet of midden and privy.

Strict attention has to be paid to these billets. Troops are forbidden to use the civilian privies, and water is drawn only from approved sources.

During the hot weather the middens present considerable difficulty, as the fresh manure, &c., afford an excellent breeding-place for flies. They are treated by one of the following methods:—

(1) Emptied and contents spread on land and ploughed in, or, if the ploughing season is over, heaped into proper middens, 200 yds. from billet, treated with chloride of lime and sprayed with 5 per cent cresol solution (3 fluid ounces liquid cresoli saponatus forms to 1 gallon of water).

(2) Covered with 1 ft. of earth and treated with chloride of lime and cresol solution.

(3) Dished up, covered with straw and treated with chloride of lime and cresol solution.

In all cases no fresh manure is placed in the pits after treatment.

Fresh manure from stables and horse-lines is carted daily direct to farm land for ploughing in, or built into proper middens, as above, and sprayed daily with a 5 per cent cresol solution until about a week old.

THE SANITARY AREA.

As soon as possible after the arrival of troops at the billets the preparation of latrines, &c., is proceeded with to prevent fouling of the site by casual resort.

The latrines, urinals, and other sanitary arrangements are made at the rear of billets. They are not

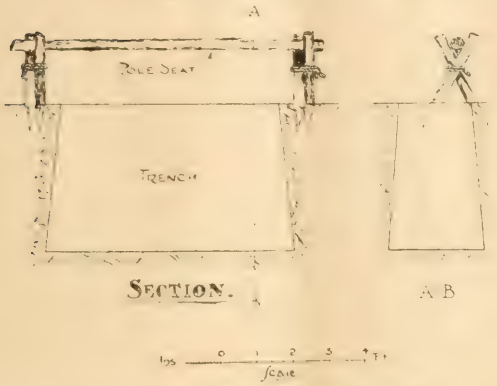

Fig. 4.—Deep Trench Latrine.

tied immediately scattered on the site, but are confined to a definite part of it which is called the "sanitary area." (Fig. 3.) When a unit vacates a set of billets these areas are marked for information of units following.

The site for the "sanitary area" is always carefully selected with reference to water supply, kitchens, and prevailing winds, and it is made as far as is conveniently possible from billets. Disinfectants are used daily in this area to keep away flies.

FLIES.

The fly question is one of the utmost importance, as it is owing in great part to these pests that intestinal diseases are spread. They breed best in fresh stable manure, and have a great liking for human excreta, on which they feed on every possible occasion. It is owing to the possibility of "carriers" that flies are so dangerous. After a meal off human excreta they may settle on the soldiers' food. They are able to transfer disease germs from the one to the other by three methods. The germs may be entangled in the legs or wings. If the food on which the fly settles is solid it will vomit sufficient liquid to dissolve the food. There is also a good chance of it depositing infected excreta on the food, as it defæcates every few minutes.

For this it will be seen that any material in which flies breed and all excremental matter, refuse, &c., must be dealt with and disposed of as soon as possible, and that arrangements be made to keep all food covered.

An improvised flyproof food safe is made from a wooden ration box. Square openings are cut in the sides over which are fixed pieces of perforated tin from biscuit tins.

DISPOSAL OF EXCRETA.

The method for disposing of the excreta and the type of latrine used has varied considerably. The matter has received a great deal of attention, and there has been a steady improvement on the old methods.

As the system chosen depends mainly upon the amount of space available in the vicinity of billets, I will first describe the methods adopted when units are in country districts.

COUNTRY DISTRICTS.

During the winter of 1914-15 and wet weather following, the long and deep trench latrine (Fig. 4) was in general use. This consists of a trench about 6 ft. long, 2 ft. wide, and 4 ft. to 14 ft. deep, over which is fixed a rough pole seat. The excreta are covered once or twice a day with pulverised earth or chloride of lime.

As warmer weather approached these deep trenches caused considerable nuisance owing to the uncovered excreta attracting flies, and for this reason the short and shallow trench latrine was introduced; with this form of latrine the excreta are covered with pulverised earth immediately after deposition, and they are rapidly broken down to a harmless mould by the action of the nitrifying bacteria, which are contained only in the upper layers of the soil. The latrine consists of a number of trenches 3 ft. long, 1 ft. wide, and 1 ft. 6 in. to 2 ft. deep. These are dug 2 ft. 6 in. apart to allow of a second set being dug in between the first set. The excavated earth is finely pulverised and placed at the back of the trenches, together with the turf. When filled within 6 in. of the surface the trenches are filled in and the turf replaced. These are used at the rate of 5 per cent. and last from two to three days.

From a theoretical sanitary point of view this is an ideal method of disposing of human excreta, but it was soon found to have two great disadvantages. It is not economical as regards ground space after a

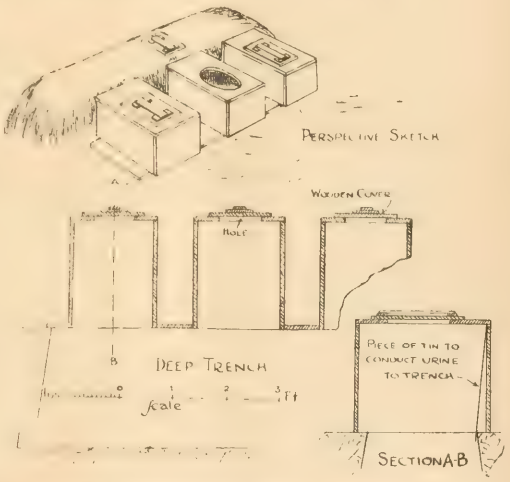

Fig. 5.—Fly-proof Deep Trench Latrines.

short time it was difficult in many places to find unfouled ground near the billets for latrines.

Another disadvantage is that it is difficult to get the men to cover their excreta with earth, although a scoop is provided at the latrine for this purpose and every other means is used to make them.

To obviate these disadvantages numerous experiments were carried out by the Sanitary Section and new systems were brought into force. For country districts an improved form of deep trench latrine was introduced (Fig. 5). It consists of a deep trench, wider at the bottom than the top, over which are fixed at intervals wooden-box seats with covered openings to exclude flies. The covers are made self-closing. The intervening spaces between the boxes are covered with pieces of wood. On the front inside of the box a piece of tin is fixed to guide the unavoidable urine into the trench.

During the winter months these are kept under cover as much as possible, and light movable sheds are made by the regimental Pioneers.

The seats are washed with cresol solution, and chloride of lime is sprinkled in the trench daily, and when filled within a foot of the surface the trench is filled up with earth.

Another system which was introduced was to burn

the excreta; this is not, however, used in country districts where there is space for the deep trenches.

DISPOSAL OF EXCRETA IN TOWNS, ETC.

In town areas and villages the bucket system of latrines is used, the fæces being collected daily and buried in deep pits or burnt with the refuse in specially constructed incinerators. If the area is large the fæces are collected in covered barrels, but generally in the villages it is arranged for the incinerators to be built conveniently close to latrine sites.

Fig. 6.—Open Bucket Latrine.

The latrines are arranged to serve as many billets as possible, and take several different forms. The open bucket latrine, consisting of a row of buckets or biscuit tins and a pole seat (Fig. 6), is the simplest form, and is used only as a temporary arrangement until other materials are obtainable. Strainers (A) made from perforated biscuit tins are sometimes used in buckets to keep the excreta separate from unavoidable urine, and also to prevent fouling of the buckets. A better form of latrine has a biscuit tin container

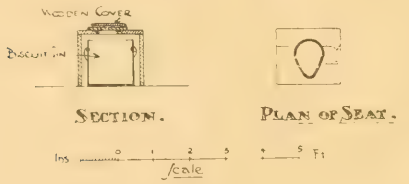

Fig. 7.—Box Latrine.

covered with a wooden-box seat and fly-proof cover. (Fig. 7.)

It is essential during the winter months to have these latrines constructed under cover. They are placed under sheds or in outbuildings, or light sheds are made by the regimental pioneers or Royal Engineers.

If it is intended to bury the excreta, cresol solution is placed in the buckets after emptying; but if they are to be burned, straw or sawdust is used.

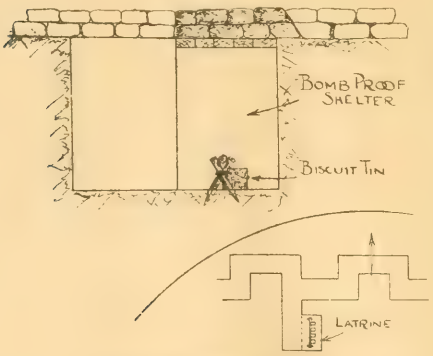

Fig. 8.—Trench Latrine.

Urinal buckets or tins are placed near the latrines, the urine being drained into covered pits.

URINALS.

If sufficient ground is found in the vicinity of billets, soakage urinals are constructed. These consist of pits about 4 ft. deep and partly filled with burnt tins, bricks, &c. The earth is then thrown back lightly, leaving a groove at the side to allow the urine to drain to the bottom of the pit. The men urinate into biscuit tins fixed at a convenient height, perforated at the bottom to allow the urine to discharge into the pit. Night urine buckets are placed outside each billet at dusk and emptied each morning into the urine pits.

SANITATION IN THE TRENCHES.

In trench areas there are special difficulties to contend with as regards latrines and urinals. The space is very limited, and there is much greater risk of nuisance.

I believe that in the early stages of trench warfare it was the custom of our Tommies to deposit their excreta in the tins which had contained their ration of jam or bully beef and throw the whole lot over the parapet into the German lines. This worked very well until the enemy copied the idea, and it was discontinued by a sort of mutual agreement.

Fig. 9.—Turf Incinerator.

It is necesary that trench latrines should be protected from the enemy's fire, so that they may be used at all times with safety. (Fig. 8.)

Buckets or biscuit tins are used, cresol being placed in the receptacles before use. The contents are emptied and buried behind the trenches at night.

Where practicable the deep trench latrine with fly-proof covers and the covered soakage urinal are used.

Refuse from trenches is collected in sacks or tins and buried behind the lines.

REFUSE DISPOSAL.

The refuse consists of jam and meat tins, paper, straw, old clothing, and waste food. All refuse is

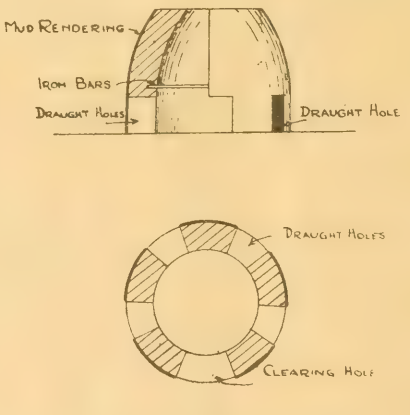

Fig. 10.—Brick Beehive Incinerator.

burned in an incinerator, and any remaining after incineration is buried in deep pits and covered with 2 ft. of earth. It is more general now to dispense with the refuse pit as there is a great temptation to throw food, slops and vegetable *débris* in them, thereby causing nuisance. It is often the practice to use the burnt tins and ash for making paths in muddy places. The incinerators are invariably built on the beehive principle, and are made of brick or turf. (Figs. 9 and 10.)

(To be concluded.)

Law Notes.

EDITED BY J. B. REIGNIER CONDER, Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, on one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed. All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment. Unless these conditions are complied with we cannot undertake to reply to queries.

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. The letter X, combinations such as X.Y.Z., and words such as "engineer", and "surveyor," should never be used.

BUILDING BY-LAWS: ADDITIONS: EXEMPTED BUILDINGS: SURFACE WATER DRAINAGE.—"Bon Accord" writes: Your reply in THE SURVEYOR of September 29th has to pay query (1) regarding plans of additions to old buildings states that in districts in which sec. 23 of the Public Health Acts Amendment Act, 1907, is in force plans could be called for. The buildings are now completed, but although notice to submit plans has been served, plans have not been submitted. What is my next step? (2) Some time ago I laid out, or made up, estate roads under the Private Street Works Act, 1892. Surface-water drains only were laid—*i.e.*, there were no sewers for sewage. The drains discharged into a 9-in. trunk sewer in the county highway, which in turn discharged into a ditch on the opposite side of the county road, an ancient watercourse running between private lands. The water from the estate roads, previous to the roads being made up, discharged into the ditch in question by means of gully grates connected up to a drain which discharged to the ditch. An owner of property lower down now complains and threatens an action for damages caused by flood water in times of heavy rains, overflowing and damaging garden produce. I, of course, contend, this being a natural watercourse to which the land—*i.e.*, estate roads, etc.—did drain, together with water from the county highway, that we had a perfect right to connect up our new drains to it. (3) Many persons here in this district endeavour to evade our by-laws by erecting at the rear of their premises stables, sheds, &c., not exceeding 6 ft. in height, and contend that they have a perfect right to do so. There is no mention of such exemption in our by-laws. I should much value your opinion respecting this matter.

1. Assuming that the additions involved any of the operations specified in sec. 23 of the Act of 1907, and that that section is in force in the district, notice should be served upon the owner under bye-law 20 to show cause why the work should not be removed, altered, or pulled down. (2) In my opinion the surface-water drains are "sewers," see *Rossiter v. Rolfe Lane and Building Company* (57 J.P., 692); and the council are entitled to discharge water from such "sewers" into the natural watercourse; see *Durrant v. Rye* (*ante*, vol. xxxi., 18). (3) A building is not exempt from the operation of the by-laws merely because it does not exceed 6 ft. in height. It is possible, however, that some of the buildings in question may fall within one of the exemptions specified in by-law 2 or by-law 3.

HIGHWAY MATERIALS FOR REPAIR.—"TRIX" writes: For many years my council has quarried stones on a parish common and used them for road repairs, both in the parish in which the common is situated and in the adjoining parishes. The common is one on which parishioners can cut wood (scrubby oak, &c.), bracken, and other growth. Stones can, of course, be taken free of dues or royalty for use of roads within the parish, but can they be so taken and used a few yards over the boundary, actually in an adjoining parish? If not, can the lord of the manor demand an excessive price per yard as royalty? (The word "excessive" used above is as regards comparative royalties paid in other parts of the district and county.) Can the lord of the manor actually fix the royalty? No suitable stone can be procured in the locality in which this common is situated, except from the estate of the lord of the manor. What is the council's position in this matter?

Under sec. 51 of the Highway Act, 1835, the council can quarry stones on the common and use them for the repair of the roads in the adjoining parishes, provided (1) sufficient material cannot be conveniently had in the latter, and (2) sufficient is left for the use of the roads in the parish in which the common is situated. No royalty is payable.

DEFECTIVE CLOSETS: DRAIN AND YARD PAVING.—"Electric" writes: Five houses owned by A in an urban district are at present provided with two hand-flushed closets, which, together with the drain from them, are defective and causing a nuisance. The gullies, which are connected with the drain and take surface water, are also defective, as well as the paving of the yard. The council wish to serve notice on the owner to provide new drain, gullies, two water-closets, and properly paved yards. (1) Can the council serve notice under sec. 36 of the Public Health Act, 1875, for the whole of this work, and, failing the work being done, do it themselves and recover cost? (2) The Public Health Amendment Act, 1907, being in force, would separate notice have to be served under sec. 25 for the paving of the yard? (3) Under what other section could council proceed?

(1 and 3) Notice to provide a water-closet for each house can be served under sec. 36 of the Public Health Act, 1875, and notice to provide a new drain for each house can be served under sec. 23 of that Act. If the notices are not complied with the council can do the work and recover the cost. (2) Yes.

PAYMENTS TO SERVANT OF LOCAL AUTHORITY ON MILITARY SERVICE.—"Fair Play" writes: An employee of a local authority joins the Army, and, under the resolutions of his council, he is allowed full salary after deducting the amount of the Army pay, but not the value of any rations or other allowances. Subsequently, his council pass a resolution that from a certain date the Army pay is to include separation allowance made by the Government. You are requested to advise in the circumstances whether, (*a*) the council has the right to vary the former resolution, which forms the basis of a contract between employer and employee; (*b*) an employee affected in consequence of the passing of the second resolution has a right of action by reason of his pay being reduced. The amending resolution was passed prior to the passing of the Local Government (Emergency) Provisions Act, 1916.

In my opinion the first resolution was binding only to the extent to which it could have been passed if the Act had been in force at the time—*i.e.*, for the payment of the salary less military pay *and allowances*. I think, therefore, that the authority had power to vary it by the second resolution, and that the employee has no right of action.

EXTRAORDINARY TRAFFIC.—"W. A." writes: The owner of a certain works in this district has substituted for about six horses and carts a steam wagon of 5 tons capacity and three horses and carts to convey material over a road to the railway station. The material has been conveyed exclusively by horses and carts so long that it is now considered "ordinary traffic," but, seeing that the mode of conveyance has been changed, can the owner be made to pay for "extraordinary traffic" or "excessive weight," and if so, under what section of the Highway Act?

The question whether weight is "excessive" or traffic "extraordinary" is to be determined by reference to the ordinary traffic on the road, and to the character of the road. If the use of the steam wagon substantially increases the burden imposed by the ordinary traffic on the road it would probably be held to be "extraordinary traffic," and in that event the council could recover, under sec. 23 of the Highways and Locomotives Amendment Act, 1878, such expenses as might be proved to have been incurred in repairing the road by reason of damage arising from such traffic.

Alien Contractors.—At Wednesday's meeting of the Liverpool City Council, Mr. Gates asked when the Finance Committee would obtain a report from the town clerk giving the names of all alien directors and shareholders of companies on, or applying to be put on, the corporation list of contractors. The town clerk said there were about a hundred such firms, and he was afraid it would take some months to obtain the information through Somerset House. Mr. Gates said that all that was contemplated by the mover and seconder of the resolution was that the firms themselves should be applied to for the information. Purely British companies would be glad to give the information. He wished the information to be applied to this year's list of tenders. The town clerk said he would adopt Mr. Gates's suggestion, but the inquiry would have to be done very carefully.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Barking U.D.C.—The council have referred to the Library Committee an offer by the Carnegie United Kingdom Trust to make a grant of £6,000 for the provision of a public library building.

HOUSING AND TOWN PLANNING.

Barking U.D.C.—It has been decided to apply to the Local Government Board for authority to prepare a town planning scheme.

South Shields R.D.C.—It has been decided to proceed with the town planning scheme for the west side of the district, and to apply for authority to plan the remainder of the area other than Harton, which is included in the joint scheme of South Shields Corporation and the rural council.

Woolwich B.C.—The borough engineer, Mr. J. Sutcliffe, has received instructions to proceed with the preparation of a town planning scheme as opportunity offers.

MOTOR TRANSPORT.

Gloucester T.C.—The Watch Committee have passed a recommendation for the purchase of an additional motor fire engine.

Islington B.C.—It has been agreed to purchase a motor sweeping machine for £650.

Walthamstow U.D.C.—It has been agreed to purchase a motor lawn mower.

Withernsea U.D.C.—Quotations are being obtained for motor fire engines.

REFUSE COLLECTION AND DISPOSAL.

Chelmsford T.C.—The borough engineer, Mr. P. T. Harrison, reported that he obtained a sale for waste paper collected from the refuse, the first consignment realising £4 per ton on rail at Chelmsford. The price had now, however, dropped to £3 per ton. Up to the present time he had been unable to find a market for old tins.

Helston T.C.—It has been agreed to purchase a horse and cart and do the scavenging by direct labour instead of letting it by tender.

ROADS AND MATERIALS.

Burnley R.D.C.—The council have resolved to approach the Government for permission to employ German prisoners of war for the purpose of completing the work now in hand in the construction of rural roads in the Pendle Forest district.—A member said Mr. H. Pritchard, the surveyor, expressed a wish at the beginning of the war to join the Colours. The council felt they could not spare him. Since that time the whole of his office staff has gone. Mr. Pritchard has now expressed a wish to join the new battalion of road makers in France, but, while the council would have liked him to go, they felt that the work must be done by somebody, and there was no one of experience left who could take his place. The council decided Mr. Pritchard could not be spared.

Clare (Suffolk) R.D.C.—The surveyor, Mr. T. R. Smith, and three roadmen have been granted permission to join the road making contingent in France.

Dover T.C.—It has been resolved to ask the Government to release German prisoners for work on the Dover and Folkestone road, and also in quarries.

Eastbourne T.C.—With respect to the poll of owners and occupiers of premises in Devonshire-place on the question of the proposed removal of trees, it was reported that the result was: In favour of removal, 13; against, 9; no replies from 5.

Erith U.D.C.—Schemes of road repair estimated to cost £3,000 are to be proceeded with. A steam roller, with scarifier, is to be purchased for £622.

Hexham U.D.C.—It has been decided to carry out repairs to the Houtley and Yarridge road, at an estimated cost of £1,602.

Manchester T.C.—The Cleansing Department are appealing to householders to assist them in snow removal during the winter. With a depleted staff it will not be possible to deal with a heavy downfall in the customary expeditious manner. Consequently attention will be given first to the clearance of the main roads, and the footpaths are to be left until the more important work is done.

Mutford and Lothingland R.D.C.—The council have passed a resolution approving the decision of the surveyor, Mr. H. Blewitt, in offering his services for road work in France. The council also agreed to offer their plant to the War Office.

Newhaven U.D.C.—The surveyor, Mr. C. T. Cooper, has been authorised to proceed with the widening scheme in Chapel-street.

Plympton R.D.C.—The surveyor, Mr. M. Wickett, stated that every roadman in the council's employment had volunteered for road work in France, subject only to the condition that he accompanied them, and he asked the council's permission to enter upon these duties. The necessary permission was granted, the utmost satisfaction being expressed at the spirit shown by the surveyor and the men.

Stockbridge R.D.C.—The council have arranged to lend the road roller to the county authorities when it is available at £1 9s. 3d. per day for the first five days of the week and 19s. 6d. for Saturday.

Thurstonland U.D.C.—The surveyor, Mr. B. Hirst, has received instructions to prepare an estimate of the cost of repairing Top-o'-th'-Bank-road.

Uckfield R.D.C.—The council have adopted an estimate of £10,680 for the maintenance of the roads for the year ending March 31, 1918.

Wanstead U.D.C.—It has been agreed to make an offer of a sum not exceeding £50 for the land required for a proposed road improvement at the corner of Snaresbrook-road.

Westmorland C.C.—It was reported that £1,000 had been saved on the roads during the last quarter, one reason being the scarcity of labour. The chairman of the Roads Committee, Mr. G. H. Pattinson, said the council were sending out a number of the highway officials and roadmen from Westmorland to look after the military roads in France, and could do with a hundred German prisoners on the roads in the county. He thought the Germans should be paid 7d. a day, which was the sum paid to British prisoners of war engaged on similar work in Germany. The council adopted a resolution urging upon the Government the desirability of using prisoners of war on work of national importance, such as the repair and maintenance of the main highways.

Westhampnett R.D.C.—The council have agreed to join with the Admiralty and the War Office in the work of restoring Marine-road, Selsey.

West Penwith R.D.C.—The surveyor, Mr. C. Noy, has submitted a report in which he says: "The highway work in general, almost throughout the district, is in a very backward state, owing to the scarcity of manual and team labour. It means that the supply of material will be reduced 40 per cent throughout the district, and that the manual labour, which consists in trimming hedges and cleaning water tables, will be carried well into March before completed. Although the scarcity of manual labour applies to the whole of the contractors, the scarcity of team labour affects those contractors who rely on others to do their carting. In some parts of the district the carting was done almost solely by the farmers between their busy seasons. It appears that several of these farmers have had exemption from military service by reason of their farming occupation. Consequently, they object to do any carting or highway work. From a highway point of view this shortage of carting is serious." The council have resolved to forward the report to the local tribunal with a view to their placing the position of the farmers before the military authorities.

SEWERAGE AND SEWAGE DISPOSAL.

Belfast T.C.—The Minister of Munitions has written regretting that he is unable to grant a licence to complete the construction of a ferro-concrete outlet

sewer, at an approximate total cost of £63,697, but expressing his willingness to permit the execution of such protective work as may be necessary.

Chelmsford T.C.—The Joint Sewerage Committee presented a report showing that the loss on the year's working of the sewage farm was £153. It was explained that 40 acres had been added to the farm. The labour bill was heavy, much heavier than the ordinary farm of the same acreage, owing to the fact that so much water had to be dealt with.

Lambeth B.C.—The reconstruction and extension of the sewer in Woodland road is to be carried out at an estimated cost of £3,375.

WATER, GAS, AND ELECTRICITY.

Belfast T.C.—The city council last week agreed to the proposal of the Tramways and Electricity Committee that Sir John Snell be called in to advise as to what modifications, if any, should be made in his report of August, 1914, on the question of the extension of the electricity undertaking, with a view to meeting the growing demands for power.

Birmingham T.C.—The charges for electricity and gas supplied by the corporation departments are to be once more raised, in the case of the former by another 15 per cent, and in the case of the latter by further increases of 4d., 3d., 2d., and 1d. per 1,000 cubic feet.

Dublin T.C.—The accounts of the electricity undertaking for last year show a surplus of £8,840, as against £1,416 for the previous year.

Hull T.C.—It has been agreed to approach the Local Government Board for sanction to proceed with the water-cooling installation at the electricity works, this being considered necessary owing to the increased output.

Pontefract T.C.—The council have raised the price of gas from 3s. 7d. to 4s. per 1,000 cub. ft., as compared with 2s. 11d. twelve months ago.

Preston T.C.—Works of shingling are to be carried out at the new Alston reservoir in order to augment the storage capacity.

Ripon T.C.—The Board of Trade have declined to allow the city council to proceed with their application for a Provisional Order for the supply of electricity, but at a special meeting on Monday last a resolution was adopted urging the board to reconsider their decision.

Tynemouth T.C.—Negotiations with respect to wayleaves are progressing in connection with the scheme for laying a supply pipe and constructing a reservoir for the supply of Ashington and other districts. The work itself will be put in hand as soon after the war as practicable.

Wimbledon T.C.—The town council are seeking Parliamentary powers to supply electricity to Epsom and Cuddington.

Wrexham T.C.—It has been agreed to increase by 10 per cent the charges for electrical current as from January 1st. As showing the almost complete discontinuance of street lighting in the borough, only 250 units were consumed by public lamps during October last, against 17,850 in the corresponding month of 1915. In the same period private lighting decreased from 30,248 units to 22,803.

MISCELLANEOUS.

Middlesex C.C.—The council have approved of the principle of "decimal" system as applied to coinage and weights and measures, and at the same meeting it was stated that the County Councils Association have received information that many councils have adopted a similar resolution.

Scarborough T.C.—The borough engineer, Mr. H. W. Smith, submitted a plan for an additional tier of seats for the South Beach bathing pool, and he was authorised to carry out the work at a cost not exceeding £200.

Sidmouth U.D.C.—It was reported that the surveyor to the Exmouth Urban District Council, Mr. S. Hutton, had examined the damage to the esplanade, and had prepared levels. The matter would be further discussed with Mr. Hutton at a special meeting, and that gentleman, it was stated, would also advise them in regard to repairing the damage to the sewer outfall.

Smethwick T.C.—It has been decided to pay an additional war bonus of 2s. 6d. per week to all workmen over twenty-one years of age, and a bonus of £10 per annum to all married men of the non-manual staff in receipt of salaries not exceeding £155 per annum, and of £5 per annum to other members of the permanent staff within the same limit of salary who are over twenty-one years of age, the extra payments to be continued during the war and for three months afterwards.

Spenborough U.D.C.—A committee has been asked to report on the provision of fire-extinguishing appliances for Cleckheaton.

PERSONAL.

Mr. W. H. Faint, Farnborough, has been appointed assistant in the Guildford borough surveyor's office.

Mr. S. P. Andrews, borough surveyor of Faversham, has been released by the town council for road service in France.

Mr. James Duncan, burgh surveyor of Ardrossan, has been appointed water engineer in succession to the late Mr. Anderson.

Mr. R. E. Riddle, surveyor to the Bellingham Rural District Council, has volunteered for road service abroad with the Royal Engineers. During his absence the clerk, Mr. Robert Riddle, will act as surveyor.

Mr. B. White, assistant surveyor to the Bowland Rural District Council, who enlisted shortly after the outbreak of war, and has been discharged from the Army after being severely injured, has been reinstated in his position by the council.

Mr. R. Clarkson, surveyor to the South Shields Rural District Council, has been granted a gratuity of £100 to cover the expense of extra services rendered in various matters during the last two years, and the council have also agreed to pay him £1 per week extra until the end of the war to cover the increased cost of petrol.

Mr. A. E. Prescott, borough surveyor of Eastbourne, has been offered, and, with the sanction of the town council, has accepted, a post as Army Roads Officer, with the rank of Major in the Royal Engineers, for work in France. Mr. Prescott has been heartily congratulated by the town council upon his appointment.

Private R. A. Allback, 10th Royal Fusiliers, eldest son of Mr. W. Allback, the popular and genial chairman of Claridge's Asphalte Company, Limited, is lying in the 1st Southern General Hospital, Edgbaston, suffering from compound fracture of the thigh and other injuries received in some of the recent fighting on the Western Front. We wish him a speedy recovery, and offer our sympathy to his family.

Dorking Urban District Council have referred to a committee the question of the appointment of a surveyor in succession to Mr. W. A. Clegg, recently appointed to Littlehampton.

The appointments are gazetted of Brevet Lieutenant-Colonel (temporary Brigadier-General) H. O. Mance, D.S.O., R.E., to be Director of Railways, Light Railways, and Roads, and of temporary Major (temporary Lieutenant-Colonel) A. S. Collard, R.E., to be Director of Inland Waterways and Docks, with the temporary rank of Brigadier-General while so employed.

OBITUARY.

Monmouthshire County Surveyor.

Mr. William Tanner, surveyor of the Monmouthshire County Council, died suddenly at the offices of the county council on Monday, the *South Wales Daily News* reports. He was out on Sunday night, but had not been in the best of health for some time. When he collapsed in the office, two medical men who were in the building were called in, but they could only pronounce life extinct. Mr. Tanner resided at Newport, and was a bachelor. He was a native of Newport, and was articled to Mr. A. O. Watkins. On the completion of his articles he went to Leicester for three years, but left there in 1874 to take up the position of assistant surveyor under the Newport Corporation. In 1883 he received the appointment by the Monmouthshire Quarter Sessions of county surveyor for Monmouthshire, when there were 114 applications for the position. Mr. Tanner had designed a large number of buildings, including the county council offices at Newport and the Court of Quarter Sessions at Usk. He was a member of the Institution of Municipal and County Engineers and the County Surveyors' Society, and a Fellow of the Surveyors' Institution.

CLAIM FOR EXTRAORDINARY TRAFFIC.

ACTION BY THE BEVERLEY RURAL COUNCIL FAILS.

At the West Riding Assizes last week, Mr. Justice Low heard an action by the Beverley Rural District Council, who claimed £600 damages from F. T. Walker, contractor, Sheffield, for the expense of repairing a road damaged by extraordinary traffic.

Mr. W. J. Waugh, K.C., for the defendant, said that the action was brought under a statute which provided that where, by a certificate of their surveyor, it appeared to an authority liable to repair the highway that, having regard to the average expense of repairing highways in the neighbourhood, extraordinary expenses had been incurred by excessive weight or extraordinary traffic, the authority might recover damages. He said there was in this case nothing in the nature of the comparison required showing that extraordinary traffic had been incurred.

Evidence having been given by the surveyor and the chairman of the Highways Committee, his lordship said the initiation of proceedings under sec. 23 of the Highways and Locomotives (Amendment) Act, 1878, depended upon the highway authority coming to a certain opinion because of the surveyor having certified certain facts. In this case the surveyor's certificate was in a somewhat peculiar and quite unusual form. It contained no reference to any expense, average or otherwise, of repairing highways in the neighbourhood, and nothing more appeared by the resolutions of the council authorising the taking of proceedings. It was quite clear that neither the surveyor nor the council had ever considered the question as to what was the average expense of repairing highways in the neighbourhood; they either did not know, or had entirely forgotten, that that was under the statute a material matter for their consideration. He was of opinion that neither had the condition been applied, nor had the event happened which alone gave a right to a highway authority to put this litigation in motion. The plaintiffs had failed to bring themselves within the terms of the section, which was meant by Parliament to afford protection both to the ratepayers and to the users of the road against ill-considered proceedings.

Judgment was given for the defendant with costs, and stay of execution was granted for twenty-one days.

An Exeter War Bonus.—At their last meeting Exeter City adopted a recommendation to give an additional war bonus of 2s. 6d. per week, up to a limit of 30s., to the men employed in the surveyor's department. It was mentioned that the bonus represented £2,386 per annum, nearly a 2d. rate.

"Antiquated" Street Lighting at Wells.—In the course of the last meeting of the Wells Town Council, Alderman C. Norton presented a report from the Lighting Committee to the effect that twelve lamp standards, with lanterns and oil lamps complete, had been purchased, and would be placed at various points during the course of the next few days. Alderman Norton, explaining the reason for reverting to this "antiquated method" of lighting, said the committee demurred at the gas company's suggestion for the payment of £181 a year for the maintenance and interest on capital for the existing gas standards, and said the company had refused to accept what he considered a generous offer. The report was adopted.

Middlesex's Way with Conscientious Objectors.—The Highway Committee of the Middlesex County Council last week reported that one of the staff of the county engineer (Mr. H. T. Wakelam) engaged on the Great West Road had obtained from the Army Council exemption from military service on religious conscientious grounds, and the Committee on Work of National Importance had approved of his present occupation as a civil engineer and surveyor as work of national importance. After careful consideration the committee recommended that he be given leave of absence without pay for the duration of the war. Mr. Grimsdale could not understand why they should show such consideration to a conscientious objector. Some wounded officer might come back from the war and be very glad to take up this work, and why should they have to tell him that the appointment would be only temporary because they were going to have a conscientious objector back at the close of the war? He moved that they give the man a month's notice, and get rid of him altogether. Dr. Leeson seconded the motion, which was carried by a very large majority.

THE UPKEEP OF PRIVATE BRIDGES.

TRACTION ENGINE OWNERS' AND USERS' DIFFICULTIES.

At the annual meeting of the Traction Engine Owners' and Users' Association, held in London on Wednesday, the question of the liability of railway and canal companies and other private owners of bridges to maintain those structures at an adequate strength was considered.

The matter arose out of what the executive committee in their report described as an immensely important decision by the House of Lords—a decision which must result in a determined effort being made to bring about a change of bridge law after the war. In view of the rising tide of self-propelled vehicles, it would probably be thought advisable, the report continued, to revive the Joint Committee which sat a few years ago with the object of drafting a Bill to alter bridge law in such a way that it would no longer be possible for private companies to impose obstacles to legitimate traffic. The matter was a very serious one, for in the United Kingdom there were about 23,000 miles of railways and 4,700 miles of canals, leaving out of the question the considerable mileage of smaller private undertakings which own private bridges. The interests against which it would be necessary to fight were very strong, but at the same time it appeared to the executive committee that a Bill could be drafted in such a way that it would be fair to all parties.

Mr. W. Joynson-Hicks, M.P., legal adviser to the association, explained the position with regard to the decision of the House of Lords in reference to private bridges carrying public roads. Traction owners and users, he said, had for years had difficulties with regard to railway and canal bridges and bridges privately owned. The question was whether the owners of such bridges were bound to keep them strong enough for the traffic of to-day or only for the traffic of forty, fifty, sixty, or seventy years ago, when the bridges were built. The case had been twice heard by the House of Lords, the four judges being equally divided. On the second hearing the House of Lords dismissed the appeal, deciding by a majority that the railway company concerned in the action was only bound to keep the bridge as strong as was necessary for the traffic when it was built, though Lord Haldane was in favour of the contention that it was the duty of the bridge-owning authority to make the bridge as strong as the road on each side of it. Mr. Joynson-Hicks suggested that the carrying trade of the country should come to terms with the County Councils Association, and agree with them upon a Bill upon which they could fight the railway interests in Parliament.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATIONS FOR LOANS.

Darlington T.C.—£769 for alterations to a school.

Hackney B.C.—£6,500 for linking-up the electricity undertaking.

LOANS SANCTIONED.

Hebden Bridge U.D.C.—£450 for laying an electricity cable.

Wanstead U.D.C.—£1,500 for sewage disposal works.

Overcrowding in Edinburgh.—At a meeting of the Public Health Committee of Edinburgh Town Council last week, a report was presented by the chief sanitary inspector with regard to overcrowding of dwelling-houses. The report was to the effect that the question of overcrowding was becoming very serious, and there were certain sufficient indications that it was on the increase. This was, says the report, to some extent due to soldiers' wives and their families having accommodation with other families, but it was more so to the lack of housing accommodation in the city. At present twenty cases of overcrowding were on the books at his department. Some houses were so badly overcrowded that the air space for each person had been reduced by one-half of the minimum standard. Unless, therefore, additional housing accommodation was provided grave effects on public health might soon become apparent.

SCOTTISH HOUSING AND TOWN-PLANNING CONGRESS.

The National Housing and Town Planning Council convened a congress in Glasgow last week, the chair at the opening meeting being taken by Sir Thomas Hunter, town clerk of Edinburgh, who insisted that the housing question could not be ignored. To deal effectively with the question further legislation of a more extensive and drastic character was, he said, necessary and pressing. Upon the Town Planning Act lay the hope of the future, while in view of the emergency of the demobilisation and return of the soldiers the Government must render assistance.

A resolution was adopted welcoming the statement of Mr. Walter Long, that he had submitted to the Government a comprehensive and practical scheme for dealing with the problems of housing and possible unemployment in the building trade at the close of the war, and urging the Scottish local authorities to appoint housing committees in order that they might be ready with schemes when the decision of the Government was announced.

In a paper on "Suggested Developments in a Municipal Housing Policy" Councillor Skewes-Cox discussed the scarcity of houses and the desirability of giving local authorities greater and more varied powers to stimulate and aid constructive housing action.

Mr. P. Abercrombie, Professor of Town Planning, Liverpool University, said so many houses would be required after the war that the efforts of all the agencies concerned would be called for. In addition to the local authorities, public utility societies would, he thought, play a large part in the re-housing of the people, taking the form of groups of workmen men who agreed to co-operate in providing houses for themselves. Private enterprise should also be helped and stimulated.

At the second day's session, at which Sir John Lindsay, town clerk of Glasgow, presided, a report was submitted on the town planning work of the Scottish local authorities, together with a resolution urging local authorities to press forward with the preparation of schemes.

SURVEYOR AND WELSH COUNCIL.

AN UNREMUNERATIVE APPOINTMENT.

The *Liverpool Courier* reports that at the last meeting of the Llangollen, Dodleigh, Rural District Council a letter was read from Mr. E. Green Davies, the surveyor, resigning his position as sanitary inspector, as he was contemplating accepting a position in connection with road making in France.

Mr. Job Evans asked if it was necessary, in this case, for Mr. Davies to resign; could not the post be kept open for him?

The surveyor: Really, I do not think it is worth while. I am losing money by continuing to hold it at the salary, and would rather you accepted my resignation.

Mr. J. Roberts: Will the surveyor tell us if he considers that he is underpaid?

The surveyor: Most decidedly I do.

Mr. E. M. Roberts: Are you also resigning as surveyor of highways?

Mr. Green Davies: Certainly not.

The clerk pointed out that at various times the surveyor, who, in addition to sanitary inspector, was also inspector of canal boats, inspector under the Housing and Town Planning Act, and of petroleum storage, for all of which duties he is paid £30 per annum, had applied for an increase, a definite decision always being deferred.

The surveyor: And the workmen—the roadmen and others—in your service are not paid a living wage; they are starvation rates, and yet you farmers are getting 200 per cent. profit.

Mr. J. Roberts: Of course, living has gone up in price greatly, and our men get no more than when a sovereign was worth 7s. 6d. or 8s. more than to-day. I will propose an alteration at the next meeting.

In view of this the surveyor said he would decide by the council's action then whether they need keep his post open for him.

CIRCUMFERENTIAL ROADS.

By Prof. S. D. Adshead.

From fourth of series of lectures on the Town Planning of Greater London After the War.

Normally there is not that density of traffic in a circumferential that there is in a radial road. Probably 80 per cent. of urban traffic moves in a radial direction; at the same time, circumferential roads are an essential part of every main road plan. Circumferential roads are essential not only for the purpose of avoiding crossing the naturally congested centre when journeying between northern and southern or eastern and western sections of a city, but also for providing an immediate connection between contiguous suburbs. It is this characteristic of circumferential roads that tends to convert them into something more than mere traffic ways. Where they connect residential areas they are peculiarly adapted to the requirements of the parkway and boulevard.

The most conspicuous example of an important circumferential road in this country that I know of is the Queen's-drive, Liverpool. Here during business hours the road is practically deserted, while the radial roads that intersect it are traversed by a continuous stream of traffic. But on fine Saturday and Sunday afternoons this circumferential road becomes crowded with promenaders, and in designing it Mr. Brodie, the engineer, had in mind its peculiar use in this way. As an addition to the recreative amenities of Liverpool, it takes a very important place, and therefore in the design of this type of road care should be taken that, as far as possible, it be made a very beautiful roadway.

PAYMENT TO OFFICIALS ON WAR SERVICE.

OFFICERS' ALLOWANCES.

At the last meeting of the Guisborough, Yorks., Rural District Council it was reported that the surveyor (Mr. H. D. Woodcock), serving with the Colours as a private, had written stating that he had been offered a commission in the Army, and asking if the council would continue to make him the same allowance as at present.

Councillor Hanham: If he takes the commission have we power to grant him the allowance he now receives?

The clerk (Mr. W. Richardson): You can only allow him his salary, less Army pay for active service, which in his case would be 8s. 6d. per day.

Mr. T. E. Senior, J.P.: If he accepts the commission will he be granted the Army separation allowance?

The reply being in the negative, Mr. Senior said: He will be in a worse financial position by accepting a commission in the Army?

The clerk: Probably.

Councillor Hanham: Have we power to augment an officer's salary in the same way as we make allowance to a private soldier?

The clerk: You have no power to increase his pay.

Several of the councillors intimated they did not want to stand in the way of Mr. Woodcock receiving promotion, and it was decided that the Local Government Board be asked to permit the council to make a larger allowance with respect to Mr. Woodcock's salary than what would be granted after the 8s. 6d. per day Army pay was deducted from his salary.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Limited. Price 10s. 6d.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTH-WESTERN DISTRICT MEETING.

A meeting of the members of the South-Western District will be held at the Guildhall, Exeter, on Saturday, December 16th, at 3 p.m., to consider the following resolution submitted by the Orphan Fund, Committee of the institution:—

"That one or more Orphan Fund stewards be appointed in each district to advocate the claims of the fund, to promulgate its work, to solicit and collect subscriptions and donations, to investigate cases needing assistance, and to report to the secretary on all questions relating to the work of the fund."

It is hoped that every member will endeavour to be present.

D. EDWARDS, ASSOC.M.INST.C.E.,
Hon. District Secretary.

INSTITUTION OF MUNICIPAL ENGINEERS.

President: MR. HENRY C. ADAMS, M.INST.C.E., M.I.MECH.E., F.R.SAN.I.

President-Elect: MR. EDWARD WHITWELL, F.I.S.E., M.S.A., Engineer and Surveyor, Abersychan Urban District Council. (Lieut. R.N.V.R.)

ANNUAL MEETING.

The eighth annual general meeting will be held in London on Saturday, January 6th.

PROGRAMME.

11.30 a.m. Council meeting.

11.45 a.m. Meet in the council chamber, No. 4 Southampton-row, W.C.

12 noon. Annual general meeting.
Minutes of last annual general meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of president and council for the year 1916-17.
Installation of president.
Any other business.

12.45 p.m. Adjourn for lunch.

2.30 p.m. Reassemble in council chamber.
Presidential address.
Discussion on the following papers to be presented to the meeting:
"*A Resume* of Public Health Matters," by G. Belson Chilvers, M.R.SAN.I. (Member).
"Practical Road Work," by Geo. Rodley (Member).
"Notes on the Use of Electricity in Municipal Engineering," by Horace Boot, M.I.E.E., M.I.MECH.E. (past-president).

B. WYAND,
Secretary.

39 Victoria-street, S.W.

INSTITUTION OF WATER ENGINEERS.

WINTER GENERAL MEETING.

The twenty-first winter general meeting of the Institution of Water Engineers will be held at the apartments of the Geological Society, Burlington House, W., to-day (Friday), commencing at 2.45 p.m.

The following papers will be read and discussed:—

(1) "The Cross Hill Covered Service Reservoir for the Birkenhead Corporation," by W. J. E. Binnie, M.INST.C.E., B.A.(Cantab).

(2) "The Rating of Waterworks," by Charles Clifton, P.A.S.I.

The announcement in our issue of last week to the effect that Dr. Sidney Barwise would occupy the chair at the above meeting was made in error. The paragraph should have appeared under the notice relating to the annual meeting of the Association of Managers of Sewage Disposal Works, held in London yesterday, and was, unfortunately, transposed at the moment of going to press. As a matter of fact, Mr. F. W. McCullough (Belfast) has again been nominated for election as president of the Institution of Water Engineers, and, it is hoped, will occupy the chair at to-day's meeting.

CONCRETE INSTITUTE.

PROGRAMME OF SESSION 1916-17.

Meetings of the Concrete Institute for the 1916-17 session have been arranged as under:—

December 21st.—Prof. Henry Adams, M.INST.C.E., on "Pile Driving and the Supporting Power of Piles."

January 25th.—Mr. C. R. Peers, chief inspector of ancient monuments, H.M. Office of Works, on "The Care of Ancient Monuments."

February 22nd.—Mr. Robert N. Sinclair on "Southampton Docks, Re-modelling of an Old Dry Dock."

March 22nd.—Mr. W. Cleaver on "The Rational Design of Reinforced Concrete Wharves and Jetties, with particular reference to those for Wet Docks, having a Permanent Water Level."

April 26th.—Mr. S. Bylander on "Secondary Stresses in Structural Steel."

The meetings will be held at Denison House, 296 Vauxhall Bridge-road, Westminster.

TOWN PLANNING INSTITUTE.

ARRANGEMENTS FOR 1916-17 SESSION.

Meetings of the Town Planning Institute for the 1916-17 session have, we are informed by the secretary, Mr. Alfred R. Potter, been arranged as under:—

Dec. 8.—"Housing and Town Planning Requirements at the End of the War," by Councillor Harrison Barrow (associate).

Jan. 5.—"A New Town Plan for the City of Dublin," by Prof. P. Abercrombie, M.A., A.R.I.B.A. (member), and S. A. Kelly, F.S.I. (member).

Feb. 9.—"Monumental Memorials and Town Planning," by Prof. S. D. Adshead, F.R.I.B.A. (member).

Mar. 23.—"Road Construction and Improvements by Means of Town Planning Schemes," by W. Rees Jeffries (hon. member).

April 20.—"Town Planning in South India," by H. V. Lanchester, F.R.I.B.A. (member).

June 1.—"Draft Act, with respect to Planning and Regulating the Use and Development of Land for Building Purposes in Cities, Towns and Rural Municipalities in Canada," by Thomas Adams, F.S.I. (past-president).

In each case the chair will be taken at 6 p.m., and due notice will be given as to the place of meeting.

The Surveyor's Place.—In the course of the last meeting of the South Shields Rural District Council it was reported that the surveyor (Mr. R. Clarkson) had applied for permission to offer his services to the new road making battalion for France, but the committee to whom the application was made declined to give this as they considered he was needed in their own district, where there is such a large length of main road to look after. The clerk had been directed to file an appeal with the local tribunal if necessary. Mr. Laidler mentioned the lack of roads in France, and as they were working at a minimum in their district he thought they ought to allow the surveyor to go. If every council took up their attitude where would they be? Mr. Summerbell said they had a lot of roads to look after in their district, which were very important to the military, and if they let the surveyor go they were running the risk of these going wrong. He moved that they confirm the resolution. Mr. Hall seconded, and pointed out that they had no one who could take Mr. Clarkson's place. The chairman thought they would be well advised in keeping Mr. Clarkson at home. He thought workmen were really more wanted in France than surveyors. The resolution was confirmed.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

TEMPORARY ENGINE DRIVER.—December 9th.—Chertsey Urban District Council. £2 per week.—Mr. F. W. Greig, surveyor.

ASSISTANT SANITARY INSPECTOR.—December 12th.—West Bromwich Corporation. £104 per annum.—

Mr. A. Wickham, town clerk, Town Hall, West Bromwich.

SURVEYOR AND INSPECTOR.—December 19th. Sandgate Urban District Council. £109 per annum.—Mr. J. Shera Atkinson, clerk, Council Offices, Sandgate, Kent.

TEMPORARY ASSISTANT SURVEYOR.—Blackwell Rural District Council.—Mr. H. Silcock, surveyor, 67 Westgate, Mansfield.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

LEON, Spain.—August 15, 1917. Schemes are invited for a water supply, and also for the improvement of the sewerage system. A prize of £1,000 will be awarded to the author of the selected scheme. Secretaria del Ayuntamiento, Leon, Spain.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

ISLE OF WIGHT.—December 18th. For alteration to a school, for the county council.—Mr. J. Dutton, clerk, County Council Offices, Newport, I.W.

Engineering: Iron and Steel.

SUNDERLAND.—December 9th. For the installation of a steam turbine, alternator, and condensing plant, at the corporation works.—Mr. A. S. Blackman, manager, Electricity Offices, Dunning-street, Sunderland.

SHEPSHED.—December 11th.—For the supply of a Cornish boiler and a horizontal steam engine, for the urban district council.—Mr. R. Smith, clerk, Shepshed, Leicester.

WARRINGTON.—December 12th.—For twelve months' supply of earthenware conduit, for the Electricity and Tramways Committee.—Mr. F. V. L. Mathias, borough electrical and tramways engineer, Howley, Warrington.

JOHANNESBURG.—December 15th. For the extension of the by-products plant, for the municipal council.—Messrs. E. W. Carling & Co., St. Dunstan's-buildings, St. Dunstan's-hill, London, E.C.

BRIDGEND.—December 15th.—For the electrical wiring of a hospital, for the Hospital Committee.—Mr. D. R. Jones, clerk, Bridgend Hospital, 10 Wyndham-street, Bridgend.

WOLVERHAMPTON.—December 15th.—For heating and hot-water apparatus, for the Board of Guardians.—Mr. J. Harrison, clerk, Poor-law Offices, Wolverhampton.

LONDON.—December 19th.—For the supply of 325 tons of rolled steel bar for magnetic brake shoes, for the county council.—Chief Officer, L.C.C. Tramways, 62 Finsbury-pavement, E.C.

DURBAN.—January 3rd.—For the supply of a 3,000-kw. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation.—Electricity Department, Dock-road, Cape Town.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Ivanell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

AUCKLAND (New Zealand).—January 21st.—For the supply of mild-steel or iron gates and fencing, for the Harbour Board.—Messrs. W. & A. McArthur, Canberra House, 18-19 Silk-street, Cripplegate, London, E.C.

Mechanically-Propelled Vehicles.

MANCHESTER.—December 18th.—For the supply of a new 3-ton steam lorry, rubber-tyred, 10 to 12 m.p.h., for the corporation. The Chairman, Rivers Committee, Town Hall.

Roads.

WOMBWELL.—December 11th.—For the supply of road materials required during twelve months, for the urban district council.—Mr. W. Quest, surveyor, Town Hall, Wombwell.

WILTS.—December 11th.—For the supply of granites, basalts, limestones, flints, hauling, steam rolling, tools for roadwork, and tar, for the county council.—Mr. J. G. Powell, county surveyor, Trowbridge.

HOOLE.—December 11th.—For the supply of ordinary macadam and tar-macadam, for the urban district council.—Mr. C. Atkin, surveyor, Council Offices, Hoole, near Chester.

CHELMSFORD.—December 12th.—For the supply of 500 tons of Guernsey, Penmaenmawr, or Leicester granite, granite chippings, and team labour for street watering. Borough Engineer Municipal Offices, Chelmsford.

BERKS.—December 13th.—For the supply of broken road materials, gravel and sand, for the twelve months ending March 31, 1918, for the county council. Acting County Surveyor, Shire Hall, Reading.

SLAITHWAITE.—December 14th.—For (labour only) repaving 500 sq. yds. of street with 8-in. setts, for the urban district council. The Surveyor, Town Hall.

DERBYSHIRE.—December 23rd. For the supply of broken stone and tar-macadam, such as granite, basalt, slag, limestone, tarred macadam, and distilled tar, for the county council.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

KENT.—December 23rd.—For the supply of 35,000 tons (more or less) of broken roadstone, such as Guernsey, Jersey, or Alderney granites, Clee Hill basalt, Leicestershire granites, Penlee, St. Keverne, or other Cornish granites, Northumberland whinstone, Penmaenmawr or other Welsh granites, or other equally durable material; also 35,000 tons (more or less) of tarred macadam, 10,000 yds. (more or less) of surface-picked or grubbed flints, and 5,000 yds. (more or less) of Kent rag, for the county council.—Mr. W. B. Prosser, clerk, Sessions House, Maidstone.

SOMERSET.—December 27th.—For surface tarring on main roads, for the county council.—Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

BEXLEY.—December 27th.—For the supply of tar, highway materials, best glazed stoneware socketed pipes, and best Portland cement, for the urban district council.—Mr. W. T. Howse, surveyor.

Sanitary.

STOCKTON-ON-TEES.—December 11th. For emptying and cleansing ashpits and privies, for the rural district council.—Mr. J. Franklin, sanitary inspector, Norton.

LONDON.—December 12th.—For the collection and disposal of sewage and other refuse, for the county council.—Chief Officer, L.C.C. Tramways, 82 Finsbury-pavement, London, E.C.

WANDSWORTH.—December 14th.—For the collection and removal of house refuse, for the borough council.—Mr. D. A. Nicholl, town clerk, Council House, Wandsworth, S.W.

Stores.

WANDSWORTH.—December 14th. For the supply of artificial stone, lime bricks, cement disinfectants, granite (broken), granite kerb and setts, gravel and flints, horse hire, house refuse collection, removal and disposal, tar (refined), tar-paving works and materials, tar-pavior, and Thames ballast and sand, for the borough council.—Mr. D. A. Nicholl, town clerk, Council House, Wandsworth, S.W.

ABERDEEN.—December 18th.—For the supply of articles for the gas department.—The Gas Engineer, Cotton-street, Aberdeen.

Miscellaneous.

GLASGOW.—December 18th. For the supply of fire-bricks and fireclay retorts at the gasworks, for the corporation.—Mr. A. Wilson, engineer, 45 John-street, Glasgow.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

DECEMBER.

8.—Institution of Water Engineers: Winter General Meeting, Burlington House, W. 2.45 p.m.
8.—Town Planning Institute: Councillor Harrison Barrow on "Housing and Town Planning Requirements at the End of the War." 6 p.m.
7.—Association of Managers of Sewage Disposal Works: Annual General Meeting, Holborn Restaurant, London. 2 p.m.
11. Junior Institution of Engineers. Mr F W Lanchester, M.INST.C.E., delivers his presidential address; presentation of institution awards; presentation to retiring secretary. Institution of Electrical Engineers, Victoria-embankment. 8 p.m.
12.—Professor S. D. Adshead on "The Town Planning of Greater London After the War." University College, Gower-street, W.C. 5.30 p.m.
13-15.—British De-Tinning Company's Conference, Caxton Hall, Westminster.
15.—Illuminating Engineering Society. Mr. L. Gaster on "War Economies in Lighting." Royal Society of Arts, John-street, Adelphi, W.C. 5 p.m.
16.—Institution of Municipal and County Engineers: South-Western District Meeting at Exeter Guildhall. 3 p.m.
21.—Concrete Institute: Prof. Henry Adams on "Pile Driving and the Supporting Power of Piles." 5.30 p.m.

JANUARY.

6.—Institution of Municipal Engineers: Annual Meeting, 4 Southampton-row, London, W.C.

APPOINTMENTS OPEN.

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SANDGATE URBAN DISTRICT COUNCIL.

Applications are invited for the Office of Surveyor, Water Engineer, Inspector of Nuisances, Inspector under the Petroleum Acts, and Inspector of Omnibuses and Hackney Carriages. The appointment would be for the duration of the War for the purpose of releasing the present official for military service.

Applicants must be over military age or permanently unfit for military service.

The salary is £109 per annum.

The Officer is required to give his whole time to his duties and to reside in the district. Private practice is not allowed.

The duties include those of Surveyor or Engineer in all matters in which the Council may require the service of a Surveyor or Engineer, including the preparation of plans, specifications and estimates, and the carrying out of the works, the keeping of accounts relating to the officer's departments and works under his charge, including the main road accounts, and the Council's waterworks and sea defences.

Applications (marked "Surveyor") on the envelopes, stating age, qualifications, experience, and present employment, and accompanied by copies (which will not be returned) of three recent testimonials, must reach me not later than 9 a.m. on Tuesday, 19th inst.

No Forms of Application or further information will be furnished.

Dated 6th December, 1916.

J. SHERA ATKINSON,
Clerk to the Council.

Council Offices,
Sandgate, Kent. (3,190)

BLACKWELL RURAL DISTRICT COUNCIL.
TEMPORARY ASSISTANT SURVEYOR.

The above Council invite application for the Office of Assistant Surveyor. Applicants must be ineligible for military or naval service, competent to make surveys, prepare plans, and generally assist in the routine duties of the Surveyor's department.

The appointment is for the duration of the war, but may be determined earlier by either party upon giving one month's notice.

Application, stating age, experience and references, together with amount of salary required, to be sent to the undersigned at once.

(By order)

H. SILCOCK,
Surveyor to the Council.

57 Westgate,
Mansfield.
December 4, 1916. (3,189)

JUNIOR ASSISTANT (ineligible) wanted for general work in Borough and District.—Borough Engineer, Newark-on-Trent. (3,176)

WANTED, at once, in a Borough Engineer's Office in a North-Eastern town, a Temporary Experienced Clerk. Must be ineligible for military service. State qualifications, and salary required, not later than Monday, the 11th inst., to Box No. 1,595, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,188)

TENDERS WANTED.

DERBYSHIRE COUNTY COUNCIL.
TENDERS FOR ROAD MATERIALS.

Tenders are invited for the Supply of Broken Stone and Tar-macadam required for the Maintenance of the Main Roads, such as:—

Granite,
Basalt,
Slag,
Limestone,
Tarred Macadam,

or other suitable Materials, delivered at various Railway Stations and Wharves in the County during the year ending 31st March, 1918.

Also for the Supply of

Distilled Tar,

delivered in Seller's Barrels or Tank Wagons at Railway Stations as required.

Form of Tender and Conditions of Contract may be obtained at my Office, and will be forwarded through the post on receipt of a stamped addressed large foolscap envelope. Tenders for Distilled Tar and Tarred Macadam must be upon a Special Form, and applicants must state which Form they require.

Tenders are to be delivered to me on or before Saturday, December 23, 1916.

The lowest or any Tender will not necessarily be accepted, and the Council reserve the right to accept the whole or any part of a Tender.

J. W. HORTON, ASSOC.M.INST.C.E.,
County Surveyor.

County Offices,
St. Mary's Gate,
Derby. (3,187)

SOMERSET COUNTY COUNCIL.
SURFACE TARRING ON MAIN ROADS.

Tenders are invited for Surface Tarring on Main Roads at various places in the County during the year 1917.

The work will be done partly under direct contract for the County Council and partly through the Rural and Urban District Councils, and probably about 160 miles of roads will be so treated.

Forms of Tender, General Conditions, and Specifications, may be obtained from the undersigned, to whom Tenders, endorsed "Surface Tarring," must be delivered not later than Wednesday, the 27th December, 1916.

The lowest or any Tender will not necessarily be accepted.

GORDON R. FOLLAND,
Acting County Surveyor.

County Surveyor's Office,
Wells.
December, 1916. (3,186)

BERKSHIRE COUNTY COUNCIL.
ROAD MATERIAL.

Road Material.—For the Supply of Broken Road Materials, Gravel and Sand, for the twelve months ending March 31, 1918, for the Berkshire County Council, delivered at the railway stations and wharves in the County. Upon receipt of a stamped, addressed foolscap envelope Forms of Tender, Lists of Stations and Wharves, and full particulars will be forwarded by the Acting County Surveyor. A Contract, with two sureties if desirable, to be entered into. A specimen Form of Contract can be seen at the office of the Clerk to the County Council, Shire Hall, The Forbury, Reading. Endorsed Tenders to Mr. A. Langston Yockney, Acting County Surveyor, Shire Hall, by December 20th.

Surveyor's Department,
Shire Hall,
Reading.
December 1, 1916. (3,184)

The Surveyor

And Municipal and County Engineer.

Vol. L. DECEMBER 15, 1916. No. 1,300.

Minutes of Proceedings.

Extraordinary Traffic: The Surveyor's Certificate.

It is, of course, an essential preliminary to the prosecution of a claim for extraordinary traffic expenses that the surveyor to the highway authority should prepare a certificate in accordance with the provisions of sec. 23 of the Highways and Locomotives Amendment Act, 1878. This is in fact a condition precedent to the right to recover the expenses, which right only arises "in the words of the section "where by a certificate of their surveyor it appears to the authority that, *having regard to the average expense of repairing highways in the neighbourhood*, extraordinary expenses have been incurred." In Mr. Barnard Ladey's excellent volume on "The Law of Extraordinary Traffic on Highways" he devotes a separate chapter to the subject of the surveyor's certificate which is replete with pertinent suggestions. One of his recommendations is that the surveyor should not merely state, in general terms, that extraordinary expenses have been incurred, but, having ascertained the facts, should set them out in sufficient detail to enable the authority to form an opinion on the subject. He also points out that the certificate will require careful moulding to meet the circumstances of the particular case, and that before preparing it it will be necessary for the surveyor to investigate the expense of repairing comparable roads. To most highway surveyors these principles are without doubt so familiar as to appear trite, if not obvious, but that they are not universally recognised or acted on is shown by the recent case of *Beverley Rural District Council* v. *Walker*, in which the surveyor's certificate failed to stand the (perhaps somewhat rigorous) scrutiny applied to it by the Court, with the result that the claim was defeated and the council were saddled with costs. In the course of his judgment Mr. Justice Low (before whom the case was tried) said: "The surveyor's certificate was in a somewhat peculiar and quite unusual form. It contained no reference to any expense, average or otherwise, of repairing highways in the neighbourhood. . . . It was quite clear that neither the surveyor nor the council had considered the question as to what was the average expense of repairing highways in the neighbourhood. . . . The plaintiffs had failed to bring themselves within the terms of the section, which was meant . . . to afford protection both to the ratepayers and to the users of the road against ill-considered proceedings."

Highway authorities and surveyors would do well carefully to note this decision, and also to bear in mind the *dictum* of Lord Justice Fletcher Moulton in *Bellaney Rural District Council* v. *Poplar Union* (1911, 2 K.B., 801): "It is only," said his lordship, in that case (at p. 812), "in cases where that which has happened has made the road an extraordinarily expensive one to the authority *in comparison with its other highways of the like class* that this certificate can be given at all." It was also held in the same case that the average expense of repairing other highways is not merely a matter to be taken into account by the surveyor, but that specific evidence thereof must be forthcoming at the trial; and although a contrary view was taken as to the latter point in the earlier case of *Bromley Rural District Council* v. *Chittenden* (70 J.P., 409), it may, we think, be presumed that the later decision would prevail. At all events the authority would be well advised to be prepared to produce such evidence. The point emphasised by the Beverley case, however, is, of course, the vital importance of the certificate, and of it being in proper form.

* * *

Sanitation with the British Expeditionary Force.

This week we publish the second and concluding instalment of the intensely interesting paper on "Sanitation with the British Expeditionary Force in France," which was read by Mr. N. W. Hoskins at a recent meeting of the Institution of Sanitary Engineers. Mr. Hoskins is at present serving as a lance-corporal with one of the sanitary sections of the R.A.M.C., and the cheery and good-humoured tone of his paper speaks volumes for the enthusiasm with which the sanitary specialists who have undertaken these arduous duties are carrying on their work. The great services that are being rendered by the devotees of the science of preventive medicine in this war are but imperfectly realised by the general public. In all previous wars the question of sanitary arrangements for an army in the field had been very much neglected. Even in the South African War, for every soldier admitted to hospital for wounds, seventeen were admitted for disease. Now, however, all this has been changed by a wonderfully organised service of sanitary experts, who are definitely recognised as specialists in the important duties which they are called upon to discharge. The work begins immediately upon the arrival of troops at their billets, and continues right up to the trenches, and it covers the provision of every variety of sanitary service. It is unnecessary to deal here with all the matters mentioned in Mr. Hoskins' paper, which will no doubt be eagerly perused by all our readers. Two matters, however, are perhaps worthy of special note. We refer to the importance of suppressing the fly nuisance, and of securing the purity of the water used by the troops for drinking purposes. Official investigations in this country in time of peace led to the conclusion that flies play a lead-

ing part in the spread of intestinal diseases. Under field-service conditions the danger is considerably increased owing to the inevitable presence among the troops of a certain number of "carriers" of such diseases, so that not only is it essential to dispose quickly of all material in which the pests breed, but arrangements must also be made for keeping all food covered. Another abundant cause of illness is the drinking of impure water. The progress of ideas in this respect is humorously illustrated by Mr. Hoskins. He alleges that in South Africa anything suspected of being water was put into a bucket. If it came out when the bucket was turned upside down it was water; if it did not it was mud! In the present campaign, on the contrary, all water is distributed in carts, each of which is fitted with a sterilising apparatus. Moreover, no water is considered safe for drinking without treatment, and medical officers are specially instructed to see that none but purified water is issued to the troops. Mr Hoskins has rendered a great service in reading so excellent a paper, and we feel sure that its publication will do much towards creating a desire on the part of qualified men to take part in the glorious work which he so excellently describes.

* * *

The Rating of Waterworks.

The attempt to apply the definitions of "gross value" and rateable value, which are to be found in existing statutes to properties of a special character, such as railways, gas, water and electric lighting undertakings, has always been productive of difficulty both for the valuer and the lawyer. When it is remembered that in determining the gross value of any property for rating purposes it is necessary to ascertain the rent at which it might reasonably be expected to let *from year to year*, and that if the property is situated in more than one parish a separate rent must be ascertained for the part in each, it will be seen that this can only be done by the application of some more or less arbitrary rule. As regards waterworks, the subject was discussed in an exceptionally able and lucid manner in a paper read by Mr. Charles Clifton, M.A.S.E., at the winter meeting of the Institution of Water Engineers last Friday, and some extracts from the contribution will be found in another column. The approved method of valuing a waterworks undertaking for rating purposes is first to ascertain the rateable value of the whole by reference to the receipts and expenses. In other words, the nett profit that can be earned is taken to be a criterion of the rent which the hypothetical tenant would pay. The undertaking is then divided into the "indirectly productive" portions (*i.e.*, such matters as land, reservoirs, and trunk mains, which are conceived as not directly capable of earning profit), and the portions that are "directly productive" of revenue (namely, the service pipes and mains). The annual value of the former is then ascertained by the ordinary methods, and this being deducted from the total rateable value previously ascertained gives the annual value of the directly productive portion. This is then allocated to the several parishes in proportion to the gross receipts earned in each. Even these complex rules are simple as compared with the many pitfalls which have to be avoided in applying them to any given case in practice. The object of Mr. Clifton's paper, which was addressed to water engineers, and not to rating surveyors, was not so much to show in detail how such a valuation should be constructed as to give some hints in analysing it when made in order to enable a sound opinion to be formed as to whether the assessment arrived at is fair and reasonable. This he did by dealing at some length with such matters as the estimating of the "tenant's share" of profits, which must be deducted as an expense as representing a fair return on the capital which the hypothetical tenant himself must provide to work the undertaking, statutable deductions, and the special difficulties which occur in regard to undertakings owned by public authorities. As we said above, the paper deals with a complex subject in a singularly lucid manner, and water engineers will find it invaluable for reference if they should be called upon to advise upon any question concerning the rating of their undertakings.

* * *

The Dublin Municipal Workshop.

It is admitted that the main test of the value of municipal undertakings is that they should be conducted on strict business lines analogous in most respects to an ordinary commercial enterprise. If the conditions of employment under municipal management are better than those under private employers—and in this regard the municipality may very usefully set a good example to others—this should prove an incentive to the industry and loyalty of the employee, and consequentially to the success of the particular trading department concerned. The public estimate of the municipal genius for trading is certainly not high, and there is no doubt that in some directions this genius fails by comparison with the efforts of private enterprise. It is all the more necessary therefore that irregularities in municipal trading, when these are discovered, should not merely be sternly discountenanced, but also dealt with with exemplary vigour. Whether this has been done in the recent instance which occurred in Dublin may be open to question, but something, at all events, has been done which it is to be trusted will tend to an improvement of a most regrettable state of things. The Lord Mayor stated, at a recent meeting of the city council, that it had come to his knowledge that at the Stanley-street workshops men who were paid on an average £2 a week were constantly idle. Upon one occasion the roof of a house or shed required repairs, and there was not a carpenter in the place fit to go on the roof, the result being that three men had to be brought to do the job. The Lord Mayor very properly condemned this as "a hopeless state of affairs in any municipal authority." His further assertion that there was at the workshops a permanent staff of something like ninety-three men, and that there was not work for half of them, did not receive authoritative denial, the inference, of course, being obvious. Instead of thrashing the matter out in public for the information of the citizens—who were certainly entitled to know the whole truth—the city council decided to discuss it in committee, and it was subsequently announced that the management of the works was to be placed under conditions similar to those prevailing in outside employment. It is to be hoped that this will have the effect desired, for it is obvious that municipal workshops would incur well-deserved condemnation if they were carried on after the manner of that in Stanley-street, Dublin.

* * *

A Worthy Memorial.

Schemes for the future development of the Metropolis are distinctly in the air at the present time. We have already drawn attention to Prof. Adshead's interesting and instructive lectures, and now we have the grand idea, emanating from Mr. Herbert Baker, the well-known architect, of a new London to be created on a comprehensive plan in which gratitude for our fallen heroes and the expression of our national ideals for the future may be worthily enshrined in a really great work of civic use and art. In a long letter which he addressed recently to the *Times*, Mr. Baker uttered a warning against

the possibility of the several war memorials that will inevitably arise in the Metropolis being a series of isolated units having no relation to each other. If those who are responsible in such matters will only pay to the experience of the past, it ought not to be difficult to avoid this danger; and, ironically, that experience has also shown that as a nation we have almost always missed the great opportunities of civic art by failure in foresight and in the power of planning on a comprehensive and generous scale. As Mr. Baker said in his letter, the admitted artistic failure of London as a capital compared with Paris does not consist in the inferiority of its several objects of interest, but in their lack of relation to each other and of unity of design and purpose. The greatest mistake of the past was probably made when Wren's plan for rebuilding the City after the Great Fire was rejected—a mistake which cannot now be retrieved. Starting from where the present badly planned Metropolis, what is the best scheme for a worthy war memorial. Mr. Baker's present suggestion is for the abolition of the present railway bridge at Charing Cross (which our contemporary likens to a kitchen range placed in the main hall of a king's palace), the construction of a new bridge of worthy design, and the erection on the reclaimed south bank of the river of buildings to house a Parliament of Empire. The chief point for the present, however, is that no scheme shall be undertaken without mature thought. For this purpose it is all to the good that the public mind should be set working at once, and Mr. Baker has discharged a real service in thus early calling attention to the matter.

* * *

Increased Prices and Housing.

Among the principal causes which have led to the virtual discontinuance of house building during the war is the enormous increase that has taken place in the price of both labour and materials. Some startling figures in this connection were given at the last meeting of the Birkenhead Corporation in justification of a decision of the Health Committee not to proceed for the present with the Oxhead housing scheme. It was stated in the first place that the price of skilled labour in the district has gone up 10 per cent. while unskilled labour is 20 per cent. more costly than it was before the war. As regards materials, bricks cost half as much again, the price of steelwork and glass has doubled, while that of downpipes and gutters has trebled. The actual estimated result of these large increases was to increase the total cost of the scheme under discussion, from £80,000 to £120,000. It is obvious that the ultimate effect of proceeding with the scheme now would be that if commutation rents were charged they would have to be fixed at so high a figure that no workmen would be found to pay them after the war. In these circumstances it is not surprising that it was decided to postpone the execution of the scheme for the present, if the consent of the Ministry of Munitions can be obtained to this course. The Labour members apparently acquiesced in this decision, but at the same time they urged upon the council the necessity of being prepared with schemes adequate to the needs of the town immediately upon the conclusion of hostilities. The problem is one which is not peculiar to Birkenhead and we entirely endorse this policy of preparedness which, in our view, is of general application.

* * *

Public Works in Russia.

In a special Russian Section which appeared in the issue of our contemporary the *Financier and Bullionist* for December 7th there appeared an article of great interest dealing particularly with the openings that may arise for British contractors in connection with public works in Russia. It appears that the most likely openings are in connection with water engineering, river works, and electrical undertakings of all kinds. Russian writers on the subject (says the author) make no secret of the leading weakness in the national industrial system—namely, scarcity of money, to which they also quite correctly attribute the long delay in carrying out a series of public works that would be immensely profitable to the Russian people, from both an economic and a hygienic point of view. We may leave railways aside for the moment. They are receiving a fair share of attention, both by the Government and private contractors. Canals and other waterways, particularly navigable rivers, exist more conveniently and extensively in Russia than in any country in the world. But there is one respect in which Russia is, economically speaking, deplorably deficient—that is, in public roads. Were Russia better provided with roads, she would present a much better market for automobiles. It will be many years before her road system approaches efficiency, but she is giving great attention to this question, and there is no reason why she should not, with her own engineering knowledge and local labour, make all the roads she requires without outside assistance.

* * *

The Engineer as Arbitrator.

We have on more than one occasion noted decisions of the Courts in cases where attempts have been made to throw over the not unusual provision in an engineering contract that in the event of a dispute the engineer's decision shall be final and binding on both parties. An application to stay an action arising out of an action on a contract for the construction of water mains, &c., on the ground that a clause of this nature constituted a reference to arbitration, was recently made before Lord Coleridge J. in chambers. The clause in question was a very comprehensive one, and provided in effect that every kind of dispute in regard to the execution of the work or in regard to any matter of account, or the final balance to be paid to the contractor, should be "settled and decided by the engineers, with or without formal reference or notice to the parties or either of them, and the certificate of the engineer under his hand shall, so far as it extends, be binding and conclusive on both parties." It was further provided that "the certificate of the engineer shall have the force and effect of an award." This clause is as strong and comprehensive as it could well be made; nevertheless, it was held that it did not constitute a submission to arbitration within the Arbitration Act, 1889, and the application for a stay of proceedings was accordingly dismissed.

* * *

Notes from Ireland.

In this issue we commence a new feature, "Notes from Ireland," which it is hoped to continue regularly—not, perhaps, weekly, but as frequently as space permits. It is the hope of their author to make them of general interest to SURVEYOR readers, but especially to those holding appointments in Ireland; and he asks all interested to favour him from time to time with comments on the notes or with interesting happenings or technical comments which might be incorporated with them. Although, being human, he would also welcome encomium, he is prepared to suffer criticism, especially of the kind which is constructive and informative. All communications addressed to him at the offices of THE SURVEYOR will be duly forwarded to him. Arrangements are being made to provide a similar feature for "bonnie Scotland," and for "gallant little Wales."

The Cross Hill Covered Service Reservoir for the Birkenhead Waterworks.*

By W. J. E. BINNIE, B.A.(CANTAB.), M.INST.C.E.

Under the powers conferred by the Birkenhead Water Act, 1907, the corporation propose to impound the waters of the Rivers Alwen and Brenig, tributaries of the Chester Dee. The scheme was laid out so as to be carried out in two stages, the first of which involved the construction of a masonry dam on the River Alwen and an aqueduct to Birkenhead of sufficient size to deal with the anticipated yield of that drainage area only—viz., 7,200,000 gallons per diem, after allowing for the discharge of the compensation water to the river amounting to 3,600,000 gallons per diem.

The impounding reservoir is situated in the county of Denbigh, about 3 miles north of Cerrig-y-druidion, which lies on the Chester-Holyhead road between Corwen and Bettws-y Coed, and about 10 miles from the former.

The total length of the aqueduct from the impounding reservoir on the Alwen to the termination at the existing Flaybrick Hill reservoir of the corporation is a little over 42 miles, and it is formed almost entirely of cast iron and steel pipes.

The Act provides for two service reservoirs of equal capacity situated near Barnston, about 3½ miles south of Birkenhead; and the first of these (called the Cross Hill service reservoir) is now approaching completion, and forms the subject of this paper.

The top water-level of this reservoir is 232 ft. above ordnance datum, and the pipe-line is designed so as to discharge the full quantity of water from this service reservoir into the existing Flaybrick Hill reservoir. At the Flaybrick Hill service reservoir is situated a pumping station, which draws its supply from a deep well in the new red sandstone, part of which supply is pumped up into a water-tower to serve the high-level district adjoining this pumping station. The elevation of the Cross Hill service reservoir is not sufficient to enable water to be delivered into the top of this tower, and accordingly the pipes between the service reservoir at Cross Hill and Flaybrick Hill are designed so as to permit the water being discharged, by by-passing the reservoir, into this tower under the pressure of the balancing tank situated at Mount Pleasant on the other side of the Dee estuary, where the top water-level is 521 O.D.

The city of Birkenhead possesses service reservoirs having a capacity sufficient to meet the ordinary fluctuations of the demand, and therefore the chief function of the reservoir forming the subject of this paper is to provide storage in case of interruptions due to repairs being necessary on the long line of pipes, about 4 miles of which cross the marshes of the Dee estuary.

The reservoir is hexagonal in plan, and has an area of approximately 3·6 acres, 1 ft. in depth representing 1,000,000 gallons storage. The available storage amounts to about 28,000,000 gallons, or about four days of the anticipated supply from the drainage area. As the Alwen water is to be filtered at the upper end of the aqueduct, it was decided to cover the reservoir so as to prevent the undesirable aquatic growths which take place when filtered water is exposed to sunlight. Advantage is taken of the fact that the reservoir is covered to reduce the cost of construction, as will presently be described.

After other types of roof had been investigated, it was decided to adopt domes, supported on pillars which could be conveniently nested together by using the hexagon shape.

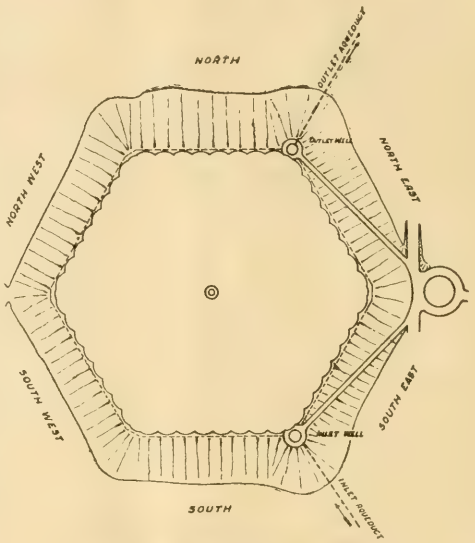
The reservoir is situated at the summit of a gently sloping hill, and the trial holes which were sunk showed that the foundation on which it would rest would be sand of such a nature that a contractor would call it rock if his schedule were so arranged as to pay an extra price for rock excavation.

The whole reservoir, when completed, will be covered with the excavated material, the bank being trimmed to a 2½ to 1 slope, the breadth of the banks behind the side walls at top water-level being 21 ft. The positions of the two reservoirs were arranged so that when both reservoirs are completed the excavations will just suffice to form the embankments.

* Paper read on Friday last at the winter meeting of the Institution of Water Engineers.

One reservoir stands on higher ground than the other, and the latter has been carried out first, a portion of the banking material being taken from a borrow-pit on the site of the second reservoir, thereby reducing the amount of excavation when the second reservoir is undertaken.

Seeing the nature of the banking material, it was decided that the side walls should be so designed as to support the embankment when the reservoir is empty, and to transmit the water thrust to the embankment when the reservoir is full. The side walls are therefore designed as a series of horizontal arches, which transmit the pressure of the embankment when the reservoir is empty to vertical plate girders, which in turn transmit the thrust to the roof and floor. There are eight of these arches in each



CROSS HILL RESERVOIR: PLAN.

side of the hexagon, each having a span of 30 ft. and a radius of 27 ft. 6½ in. At the angles where adjacent sides meet the span and the radius are 17 ft. 4½ in.

FLOOR.

The floor is, generally speaking, 12 in. in thickness, resting on a foundation of hard sand, and no water was met with in the excavation, which is above the level of saturation in the rock. When foundation level was reached, a bed of marl was disclosed below a portion of the floor. Seeing that the domes were supported on pillars, and in order to avoid unequal settlement, it was decided to remove the marl so as to obtain a uniform foundation on the hard sand. The floor, therefore, varies in thickness.

The domes are supported on 432 hexagonal pillars, and below each pillar the concrete is 2 ft. in thickness, the extra foundation being hexagonal in plan and 8 ft. in width between parallel sides of the hexagon at the base, splaying out at an angle of 45 deg. till the general floor level is reached. No cracks have been observed between the floor and the pillar foundations, which shows that a good uniform foundation was secured throughout. The foundation under the side walls is carried down to 2 ft. 3 in. below floor-level, except under the plate girders, where it is carried down to 3 ft. 2 in. below floor-level.

CONCRETE.

All concrete was specified to be 5 to 1 concrete—*i.e.*, one volume of cement to five volumes of the aggregate of crushed stone and sand when mixed together—but the exact proportion of this was left to be determined.

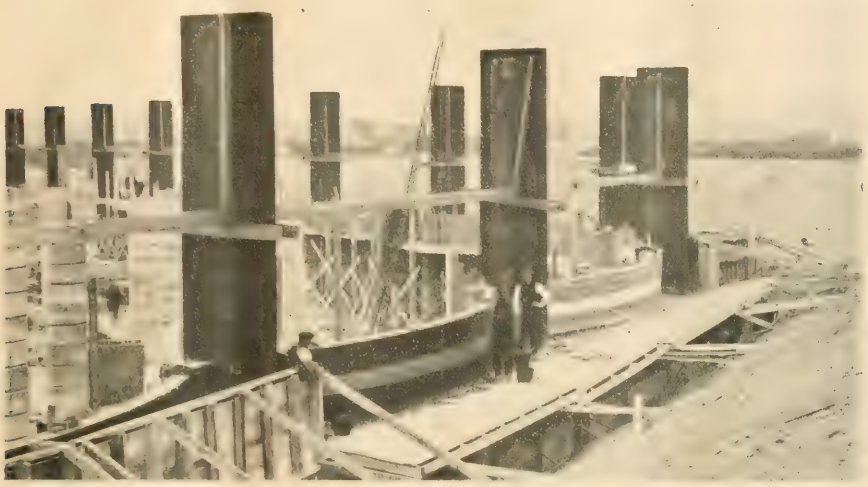
Owing to the variable nature of the local sandstone, which is often very poor stuff, it was thought advisable to specify that it should not be used, but after the work had started, the contractors (who had opened up the adjacent Thingwall quarry) came forward with an offer to reduce their price for concrete if the stone from this quarry were allowed to be used, and they submitted the results of certain tests carried out by Messrs. Kirkaldy, which showed that the stone from this quarry could bear a crushing stress of 400 to 500 tons per square foot.

There are three varieties of sandstone in the quarry—viz., white, pink and yellow. The white and pink are the best, and stood an average crushing strain of 450 tons per square foot, whereas the yellow sandstone stood 370 tons per square foot, but made an excellent sand when crushed. The average crushing stress of British sandstones used for building purposes is 450 tons per square foot.

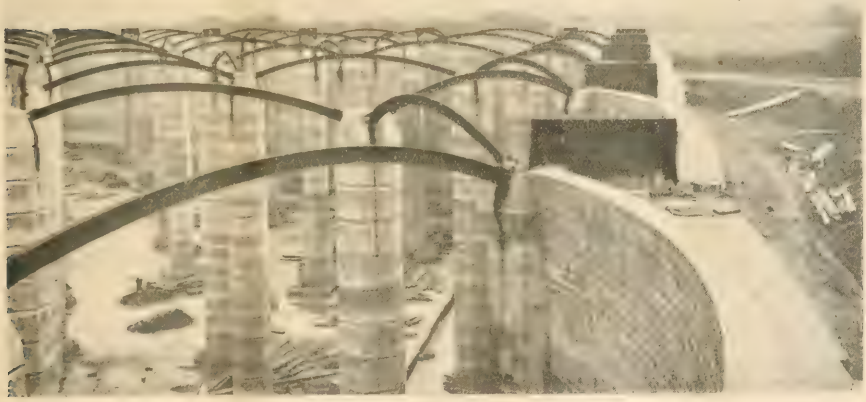
The concrete is divided into two classes—Concrete No. 1, where the maximum measurement of the broken stone was 2 in.; and Concrete No. 2, where it was $\frac{1}{2}$ in. The former was used for the floor and side walls, and the latter for the moulded blocks, groins, and the domes. The permission to use the sandstone was limited to the white and pink varieties, and to the aggregate for Concrete No. 1; and a quarry inspector was appointed by the corporation to see that no improper stone was used.

Experiments were carried out which led to the adoption of the following proportions for the materials used for the concrete, which were gauged in separate boxes. For Concrete No. 1, one part by volume of cement, 2·11 volumes of sand, and 4·16 volumes of stone; and for Concrete No. 2, one part by volume of cement, 1·93 volumes of sand, and 3·86 volumes of stone. No. 1 concrete weighed 133 lb. per cubic foot when dry, and 139·6 when saturated with water. The stone for Concrete No. 2 (which was specified to be broken to $\frac{1}{2}$ in. size) consisted of limestone chippings obtained from lead mines in Wales. Numerous experiments were tried during the progress of the work to ascertain the strength of the concrete. The tensile strength was arrived at by breaking beams at the site of the work, and the crushing tests were carried out by Messrs. Kirkaldy. These beams were 3 ft. long by 6 in. by 4 in. in section laid flat on supports placed 2 ft. apart, and loaded at the centre till they broke. These tests were carried out on the No. 2 concrete only, as this alone was subject to tension in the finished work.

The result of the tests showed that the beams failed



Cross Hill Reservoir. View of Side Walls from Outside, showing Asphalt.



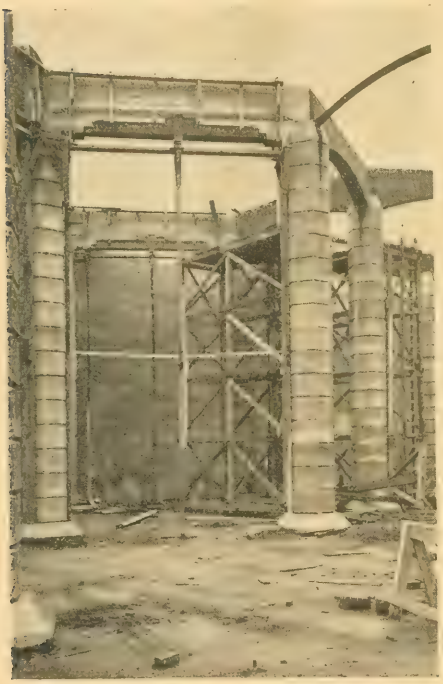
Cross Hill Reservoir. Attachment of Groin Reinforcement to Top of Pillars and Side Wall Girders.

when the maximum fibre stress was 251 lb. per square inch, the age of the beam being twenty-eight days, and 516 lb. per square inch when the age of the beam was four months. The strength of the concrete at four months was so great as to be remarkable, especially as the 3 to 1 mortar briquettes only showed a tensile strength of 287 lb. per square inch at twenty-eight days, but was afterwards confirmed by a test which will be described when dealing with the domes.

The result of the crushing tests was as follows:—

No. 1 Concrete.—The cubes were made in 9-in. moulds, and gave the following results: Strength at twenty-eight days 205 tons per square inch, and at one year 253 tons.

No. 2 Concrete.—The cubes were made in 6-in. moulds, and gave the following results: Strength at



Cross Hill Reservoir. Concrete Groins, Showing Timbering, &c.

twenty-eight days, 160 tons per square inch, and at one year 230 tons.

The results obtained were rather contrary to what was expected, as it was thought that the concrete made from the limestone chippings would bear a greater crushing stress than that made from the local sandstone. However, the figures given were obtained with cubes made from the same consignment of cement by the late resident engineer, Mr. Wilson. Nine-inch moulds were used for No. 1 concrete, as the stones were too large to get a good result in a 6-in. mould.

The special concrete blocks (which will presently be described) were made in two ways—in one case the mould were placed on a "vibratory" table, the vibration being effected by means of a cam arrangement driven by a portable engine, which raised one end of the table and allowed it to drop; and in the other case the moulds were themselves vibrated by a pneumatic hammer.

The quality of the concrete produced by this method has been very satisfactory and uniform. It is possible to obtain equally good concrete by very careful punning, but the method here adopted ensures uniformity by mechanical means, and the "human element" is largely eliminated. In order to ascertain whether there was any appreciable difference in the quality of the concrete made by the "vibratory method" and by careful punning respectively, a series of experiments was carried out, which showed that the concrete made by the former method stood a crushing stress about 6 per cent greater. It must be borne in mind, however, that the care taken in making experimental blocks is exceptional, and I feel confident that the actual superiority in practice is greater than appears from this result.

The Portland cement was supplied by the Associated Portland Cement Manufacturers, and came from Peters' Works—for the most part from their West Kent branch, where the "rotary" kiln is used. Some came from the "Lees" branch, where they use the stationary "Schneider" kiln. When manufactured it was stored in a bin at the cement works specially provided for this contract, and was sampled and tested by Mr. Bertram Blount, of York-street, Westminster, before any was dispatched, to see if it complied with the British Standard Specification. In order to facilitate early dispatch from the works, seven and fourteen days' tests were carried out to show if a satisfactory growth in strength was apparent, twenty-eight-day tests being made on the ground. On arrival at the works the cement was spread out in a shed, but was not turned over unless it proved to be too quick in setting. All the cement supplied for this contract was uniformly good, and complied with the requirements of the British Standard Specification.

FLOOR.

As it was considered that temperature cracks were unavoidable, it was decided to cover the whole floor, when completed, with a layer of asphalt, ¾ in. thick, carried under the pillars and under the side walls so as to be continuous with a sheet of asphalt sandwiched between the brick facework and the concrete backing of the side walls. It was essential that the asphalt should not be so ductile as to spread under the weight of the pillars, or to run when placed against a vertical face, and it was decided to use Seyssel asphalt spread in two layers ⅜ in. thick. This asphalt is a natural one, containing about 14 per cent of bitumen, 72 per cent of calcium carbonate, and a little siliceous sand.

Drainage is secured by giving the floor a fall of 6 in. from the centre to circumferential dished channels having a fall of 12 in. to the inlet well from the opposite corner of the tank. A 21-in. scour pipe delivers the scour water into a channel formed in the bottom of the inlet well, leading to a 27-in. drain discharging into a neighbouring stream. The scour pipe is controlled by a valve in the inlet well.

SIDE WALLS.

As already mentioned, the side walls consist of a series of horizontal arches springing from steel-plate girders 4 ft. in depth and 30 ft. 5½ in. in length. The bases of these girders rest on concrete at a depth of 2 ft. below floor level, and each girder is connected near its upper end to the steel-angle reinforcements of the groins for the domes. These girders are surrounded by concrete at the back and special brickwork at the face, these special bricks being designed to act as springers for the arch brickwork and to surround the flange of the girder. A space was left between the special bricks and the steelwork, which was filled in with Portland cement grout. The arch is of brindle brickwork set in 2 to 1 Portland cement mortar 14 in. thick to 11 ft. 3 in. above floor level, and 9 in. thick to where it meets the domes. It is backed with concrete varying in thickness from 18 in. to 12 in. at the centre of the arch, and 5 ft. at the springing where the plate girders are built in. There is a ¾-in. layer of asphalt between the brickwork and the concrete, as already stated.

At the centre of the arch the concrete is further reduced in thickness by a recess which forms part of a vertical drain taking the roof drainage. This recess is arched over by a special type of cover, made of No. 2 concrete, and used for all roof drains. It consists of a semi-circular arch of 3 in. radius, springing from two parallel sides 5 in. deep, and is 2 in. in thickness, moulded and made on the vibratory table. The top of the vertical drain is covered by a flag 15 in. by 15 in. by 3 in.

It was expected that changes of temperature would cause the concrete to crack along the line of this recess, and this proved to be the case. As the span is only 30 ft., the cracks were small—about $\frac{1}{16}$ in. wide—and it was found, when the concrete was cut out for inspection, that there was no trace of the crack through the asphalt.

The vertical drain discharges into a main drain surrounding the reservoir which picks up the roof drainage, and varies from 15 in. to 30 in. in diameter. It was thought to be an advantage to localise the cracks, which were anticipated as inevitable, and at the same time provide a means of determining

whether leakage was taking place through any particular crack by means of the drain, which also affords the opportunity of grouting up the crack if such leakage should prove to be taking place.

The side walls are not reinforced, except near top of the wall, where a longitudinal bar 2 in. by ½ in. is introduced, attached to the plate girders. When the side walls had been carried up a few feet, vertical cracks appeared through the special brick facework and the moulded concrete pedestal blocks which clothe the inner flanges of the plate-girders. It was thought at first that this might be due to expansion of the Portland cement grout which filled the space between the girders and the special bricks. Le Chatelier tests, however, failed to detect any but very slight expansion in the cement moulds even after boiling. It was then thought that the cracks (which appeared exactly at the same place and with great regularity) might be due to changes of temperature in the girders, but on investigation this explanation was abandoned. The conclusion now arrived at is that the cracks are due to the oscillation of the plate girders, due to wind action. When the wall was only a few feet high the girders were secured at the bottom, but the tops had to be stayed by temporary timber struts, which would allow of some slight movement. The cracks only extended for a vertical height of a few feet, and did not appear in the later work when the girders were securely fixed in the wall. They are quite unimportant, as they only occur through work which can have no influence on the water-tightness of the reservoir.

The plate girders intersect the asphalt layer, and great care had to be exercised to get a good junction between the asphalt and the steelwork, which was carefully cleaned.

PILLARS.

The pillars which support the roof are 432 in number, and are built up of moulded blocks consisting of No. 2 concrete, made by the "vibratory" method. There are sixteen of these blocks, 18 in. in depth of course in each pillar, resting on a pedestal. The pillar blocks are hexagonal in shape between opposite parallel sides. The top and bottom edges are chamfered, as a satisfactory job cannot be made of moulded concrete blocks with rectangular corners. The chamfered joint has another advantage, as it is very difficult to get moulded concrete blocks exact in shape unless steel moulds are used, and therefore one block would not have fitted exactly over the one below it, and the effect would have been unsightly, whereas any slight irregularity is not noticeable when the outline is broken by the chamfers.

Cross Hill Reservoir: Dome Centering.

Cross Hill Reservoir. Dome Centering in Position.

The pedestals of the pillars are hexagonal blocks of special concrete, 15 in. thickness of course, and 4 ft. 6¼ in. between parallel sides, the top 9 in. being chamfered at an angle of 45 degrees. Each pillar is surmounted by a moulded concrete cap 18 in. in depth of course, splayed at the top so as to form an abutment for the groins at right angles to the neutral axis, where it meets the column. All the pillar blocks are moulded with a central circular hole 6 in. in diameter, and the blocks are dowelled together by Portland cement-mortar filling this hole. The

top of each column is surmounted by a steel gusset-piece, to which the reinforcement of the groins are attached, and these gussets are secured to the pillars by a 1½-in. diameter steel rod, 4 ft. 6 in. in length, passing down and grouted into the central hole.

GROINS.

The groins which support the domes are of reinforced No. 2 concrete. They are 14" in. in width, project 14 in. below the dome, and are arched to a radius of 20 ft. 4 in. The reinforcement consists of rolled steel joists 5 ft. by 3 in. by 11 lb., bolted to the gussets already described. The groins were constructed before the domes were commenced, and were of such a depth and so formed as to afford abutments for the domes at right-angles to the neutral axis.

There is no tension on the groin when the work is completed, and the reinforcement was introduced for the primary purpose of securing together the tops of all the pillars, and so preventing movement under the cross strains brought to bear on them during construction. They also strengthen the groin to take the lateral thrust of the green concrete of the dome during construction and the asymmetrical loading which occurred when the dome, springing from one

CROSS HILL RESERVOIR: VIEW OF INSIDE OF DOMES AFTER CENTERING HAD BEEN STRUCK.

face of the groin only, was completed. They proved to be sufficient for this purpose during construction, though some doubt was felt on this point, and temporary struts were provided to take asymmetric loading during construction.

The specification set out the exact method of procedure, and it was arranged that all the pillars should be tied together at the top by means of this steel reinforcement before the concrete of the groins was commenced. This proved to be a necessary stipulation, for, as a matter of fact, the steelwork was not quite complete when the groins were started, and when the concrete approached the point where the steelwork had been omitted it was found that the pillars moved slightly, horizontal cracks appearing between the pillar blocks. It was also specified that all the concrete groins were to be complete before the domes were commenced, and this was accordingly done.

DOMES.

The domes are of No. 2 concrete, and hexagonal in plan, springing from the groins and resting on the tops of the pillars, the span from centre to centre of opposite parallel groins being 30 ft.

The following points determined the design:—

(1) The minimum thickness of concrete to be 6 in.

(2) The line of thrust when the dome is completed and loaded to pass through the centre of thickness of concrete, so that there is no tension.

(3) The extrados of the dome to be so formed that double shuttering should not be required at the springing—*i.e.*, the maximum inclination of the surface to the horizontal to be such that green concrete would stand at that angle.

The second condition could not be fully met as the loading varied according to whether the sand covering the tank was wet or dry, but the actual tension under other conditions is small.

The radius of the intrados of the dome varies from 50 ft. to 17 ft. as the springing is approached, and the thickness varies from 6 in. at the centre of the dome to 13 in. at the centre of the groin.

It was specified that fourteen days should elapse before the centering was struck.

Each dome was completed in one operation, so as to avoid planes of weakness. It was expected that contraction cracks would occur at the junction of the dome and the groins, and therefore no attempt was made to secure adhesion between the dome concrete and the groin; and, as a matter of fact, the temperature cracks did put in their appearance along these lines, only minute surface cracks being visible in the domes. The intersection of the domes with the groins formed a series of zig-zag valleys, into which surface drainage would find its way. These valleys were accordingly levelled up with concrete so as to give a fall of 6 in. from the centre of the reservoir to the side wall, where the drainage was delivered into the vertical pipes. Adjacent domes which meet the side wall at the plate girders to which the reinforcement of two groins is attached leave a space between the groins and the arch of the side wall. This space is covered with a roof of concrete flat on top and arched below so as to give the same rise and to spring from the same level as the domes.

It was thought desirable to carry out full-scale experiments to determine the strength of the domes. As it would not have been a very easy matter to test one of the domes to destruction, it was decided to carry out the experiments on a portion of the dome only. Accordingly a strip of the dome was constructed 2 ft. wide, the sides of the strip being parallel sections at right-angles to the springing, and the centre of the strip corresponding with the centre of the dome. It was obvious that this strip would be weaker than the actual dome, owing to the absence of lateral support. The strip formed a bridge of concrete 2 ft. wide, having the same span, the same rise, and the same thickness of the dome at corresponding distances from the centre. It was tested when it was nineteen weeks old in the following manner: It was first loaded with sand to the actual loading to which it would be submitted in practice, which amounted to 5½ tons, distributed symmetrically, but not uniformly, on the arch. One-half of the arch—*i.e.*, from the springing to the centre—was then loaded with bricks to give a uniform distribution of load, the other half being left unloaded except for the sand already referred to. Twelve tons of bricks were stacked without the arch showing signs of failure, the deflection at the centre amounting to ¼ in. Under these circumstances the maximum fibre tension occurred at a point 4 ft. 9 in. from the centre of the span, and amounted to 730 lb. per square inch. By this time the pile of bricks, on so narrow a base, had become so high that the contractors declined to proceed further with the experiment, owing to the danger to the workmen stacking bricks if the arch suddenly failed, so the actual ultimate fibre strain which the arch would have sustained was never determined. The result of the experiment confirmed the results obtained by the beam experiments at four months old which bore an ultimate fibre stress of 516 lb. per square inch in tension.

The centering for the domes, designed by the contractors, was a very workable arrangement, being easily erected and taken to pieces. Each dome centre was made up of nineteen timber segments, eighteen dome sections, and a key piece. This centre was supported on six scaffolds, triangular in plan, securely braced and mounted on wheels, one of these scaffolds being placed in position between each pair of pillars, the apices meeting at the centre of the dome. When wheeled into position they were blocked up from the floor and carefully levelled, the centre resting on the platform thus formed. At the expiration of fourteen days the centre was dismantled by first taking out the key-piece, after which the segmental pieces could be removed, and lastly the triangular scaffolds, which were wheeled away and re-erected under the next dome to be constructed.

ROOF DRAINAGE.

It was thought desirable to avoid water possibly contaminated dripping into the reservoir through cracks in the roof. These cracks, as already pointed out, occurred only along the lines of juncture of the dome and the groins. Asphalt ¼ in. thick was therefore laid to cover the bottom of the zig-zag valleys formed by the groins, and was carried 18 in. up the extrados of the dome on each side, thus forming a watertight channel with a slope of 6 in. from the centre to the side walls where the water enters the vertical drain, already described.

In order to facilitate the passage of the water special drains, similar to those already described, were laid throughout all the valleys, and were surrounded with broken stone. They were butt-jointed, and were also provided with a notch to facilitate the entry of the water, a special moulded three-branch piece being provided at the points of juncture over the pillars.

The roof will be covered with sand from the excavation, and will be finished off with soil to a level of 9 in. above the top of the domes and sown with grass-seed. The slopes of the surrounding embankment are also to be soiled and sown.

Access to Reservoir Interior. This is provided by a shaft built of brickwork 14 in. thick and 9 ft. internal diameter, situated at the centre of the reservoir, in which is placed a special staircase made of moulded concrete blocks which fit together so as to form a central hollow column, in which is placed the float of the level recorder. The walls of this shaft are pierced by six openings above water level to provide ventilation, and to release the air trapped in the roof arches as the reservoir fills. To prevent air becoming trapped in the domes 4-in. diameter cast-iron vent pipes have been built in above water level between all the domes so that the air can communicate freely from one dome to another and can make escape at the shaft.

The shaft will be surmounted by a substantial masonry structure, hexagonal in plan, providing access to the staircase and to the level-recording instrument.

In addition to the staircase, roof manholes have been provided so that long timbers, pipes, &c. can be passed through the domes.

INLET WELL.

The inlet well presents no features of novelty. It is a dry well, so that access can be had to any of the valves, and the floor is formed into channels to take the main drain surrounding the reservoir (with which the roof drains are connected), and which discharges into a 27-in. ferro-concrete pipe leading to the neighbouring stream course. The well is faced with brickwork 9 in. thick, and is circular in plan, 18 ft. in diameter. A bell-mouth overflow-pipe discharges into the drainage channels, the diameter of the bell mouth being 4 ft.

The main entering the well is of cast iron, 25 in. internal diameter, and is arranged for the extraction of a scraper, and discharges into the bottom of the reservoir. A reflux valve is provided to prevent the reservoir emptying should a burst occur on the main. The well is covered with floor-plates, and the valve spindles are brought up to the surface, a ladder providing access to the bottom of the well.

OUTLET WELL.

The outlet well is circular and 16 ft. internal diameter, being similar in details of construction to the inlet well. This is a wet well, the level of the water in the well being normally the same as that in the reservoir, and the pipe which admits the water from the reservoir is so placed as to draw out all except the last 6 in. of water which is held up by a brick kerb surrounding the recess in the floor containing the bell-mouth of the outlet pipe. The outlet pipe is provided with a valve, so that the well can be isolated and emptied into the main drain surrounding the reservoir through a 12-in. connection. The pipe leaving the outlet well is 28 in. in diameter, and is arranged to allow of the introduction of a scraper.

A special valve of novel design is provided to automatically close the outlet pipe, and so prevent the reservoir from emptying in case of a burst on the main. The entrance of the outlet pipe is turned down, and terminates in a bell-mouth partially closed by a hollow bell-shaped casting. The water leaving by the outlet pipe passes through the annular space between the bell and the bell-mouth, its static head being reduced and an upward pressure being exerted on the bell, which is kept in position by its weight. The effective weight of the bell can be altered by means of a balance-weight sliding on a lever, the other end of which is attached by a rod to the bell. If a burst occurs on the outlet main the static head, tending to cause the bell to close up into the bell-mouth, increases owing to the increased velocity of the water through the annular space, and the weight can be adjusted so that the bell starts to close—*i.e.*, the static head on the bell overcomes the weight at any predetermined rate of flow. If no arrangement were made whereby the rate of movement of the bell is restricted, the bell would come into violent collision with the bell-mouth, and the latter casting would probably be shattered. The base of the bell is therefore connected to a bed-plate by means of an indiarubber tyre, and a small leak-hole, the exact size of which can be regulated, admits water into the interior of the bell. When the valve is set the bell is filled with water, and the static pressure in the interior of the bell is the same as that in the outlet well owing to the connecting orifice referred to above. As soon as the bell commences to move upwards the volume of water enclosed between the bell, the rubber tyre, and the base-plate increases, and water is sucked in through the orifice, the size of which regulates the upward movement of the bell.

The author desires to acknowledge his indebtedness to the resident engineers and chief inspector. Mr. Lawrence Wilson was resident engineer from June, 1913, till the end of December, 1914, when he obtained a commission in the Royal Garrison Artillery. Transferred to the Royal Engineers, he was killed while performing a very gallant action in France on August 9, 1915.

The setting out of the work was no light task, as can be well imagined. The steel roof reinforcement covers an area of nearly 4 acres, and the plate-girders and pillars had to be set with such accuracy that the gussets fitted into place on the top of the 432 pillars. No one who has seen the work can fail to be struck with the extraordinary accuracy of the setting-out, on which the ease of construction so largely depended. Mr. Wilson was succeeded by Mr. Baker, of whose ability the author cannot speak too highly, and the corporation were most fortunate in securing the services of Mr. Yonart, who acted as chief inspector from the commencement of the work. Mr. Crimp assisted first Mr. Wilson and then Mr. Baker, leaving to take up munition work in April, 1916.

The contractors for the work are Messrs. R. McAlpine & Sons. The contract was let in 1913 for the sum of £79,000, or about £2,800 per 1,000,000 gallons of storage obtained. This compares with an average cost of £5,000 per 1,000,000 gallons for several covered service reservoirs constructed by the London water companies, the economy obtained being due to the special features of the design.

The contract period was two years, but this has not been fulfilled owing to the war.

Mr. Alfred McAlpine had personal charge of this contract, and was assisted by Mr. Kesson as engineer and sub-agent, to whom also much credit is due for the accurate setting out. The falsework for the groins and domes was no easy task, and great credit is due to the contractors for the able way in which they solved the difficulty.

The author is greatly indebted to Mr. J. W. M. Richardson, the water engineer of Birkenhead, for the use of the negatives showing the progress of the work since its commencement.

Tramways and Light Railways Association. The Government having taken over the greater part of Caxton House, the Tramways and Light Railways Association and the Incorporated Association of Electric Power Companies have removed from that building to Sanctuary House, 33 Tothill-street, Westminster (facing Caxton House).

1917 Diaries.—Messrs. Thomas De La Rue & Co., Limited, of 110 Bunhill-row, E.C., issue, as usual, a varied and most attractive series of diaries for the coming year. We particularise "The Onoto Diary," an ever-ready reference book containing an index of the months, and, in addition, an alphabetical index which enables an orderly record to be kept of addresses, telephone numbers, and other useful reference notes. It ranges in price from 6d., for the watch-pocket size, upwards. "The Duplex Reversible Diaries" were introduced for this year, and proved to be eminently successful. They are published in two sizes, both of which are ruled throughout and will be found most suitable for business men. "The Portable Onoto Diary" forms an ideal present for a gentleman. It can be had, in note case, for from 4s. to 25s. each.

Institution of Water Engineers.

WINTER GENERAL MEETING IN LONDON.

In the absence of the president, Mr. F. W. McCullough (Belfast), Mr. A. B. E. Blackburn (Sunderland), vice-president, occupied the chair on Friday last at the twenty-first winter general meeting of the Institution of Water Engineers, which was held at the apartments of the Geological Society, Burlington House, London. The attendance included Messrs. W. J. E. Binnie (Westminster), W. T. Burgess (Bedford Park, W.), O. Williams (Aberdare), G. T. Edwards (Leicester), H. Swinney (Chepstow), S. J. Richards (Chepstow), Frank H. Brunt (Rochdale), L. Askew (Caxton House, S.W.), H. C. Head (Winchester), James Dewhirst (Chelmsford), H. Ashton Hill (Birmingham), Fred. J. Dixon (Ashton-under-Lyne), J. C. Barrowclough (Batley), D. Halton Thomson (Portsmouth), E. J. Silcock (Westminster), Alex. H. Jameson (King's College, W.C.), J. W. Wilkinson (Ludlow), A. W. Oke (Hove), A. E. Cornewall-Walker (Redhill), C. B. Newton (Hull), Charles H. Priestley (Cardiff), A. H. Cooper (Wey Valley, Farnham), F. J. Bancroft (New Barnet), R. Askwith (Witton-le-Wear), D. Kitchingman (Southampton), S. R. Lowcock (Westminster), Frederick Hughes (Merthyr Tydfil), R. B. Rigby (Bury), Cecil H. Roberts (Aberdeen), Charles Clifton (London), E. Uwins Gillate (London), Walter J. Easter (London), Donald Dinwiddy (London), and Percy Griffith (Westminster), secretary.

Two papers, "The Cross Hill Covered Service Reservoir for the Birkenhead Corporation," by W. J. E. Binnie, M.INST.C.E., B.A.(CANTAB), and "The Rating of Waterworks," by Charles Clifton, P.A.S.I., were read and discussed in the course of the meeting, that of Mr. Binnie—reproduced on another page of this issue being presented first.

CROSS HILL COVERED SERVICE RESERVOIR.

The CHAIRMAN said he was sure they had all listened with great interest to the paper, which would form a most valuable addition to the "Transactions." Some of the members of the institution had had the privilege of seeing over the works described in the paper at a most interesting stage two or three months ago, and he hoped they would have a good discussion. The reservoir certainly had some very striking and ingenious features. One point that struck him in regard to the cost of the reservoir was that it seemed to have come out below the estimate, which was rather extraordinary at a time like this, seeing that the war had intervened since the contract was let. Mr. Binnie had himself drawn attention to the extraordinary accuracy of the setting-out, which was certainly remarkable.

Mr. C. H. PRIESTLEY (Cardiff) said he was sure, as the chairman had remarked, they had all listened with very great pleasure to the paper which Mr. Binnie had kindly given them, and those of them who had an opportunity of seeing the work itself were very much struck with the whole of the design from beginning to end. He did not know that he had many observations to make in connection with the design itself, but there were one or two points he might refer to. The first and chief point, to his mind, was that Mr. Binnie appeared to take it as an axiom that aquatic growths took place when filtered water was exposed to sunlight. He (the speaker) had had experience of two or three open reservoirs which contained filtered water. Those reservoirs had been in use from twelve to fifteen years now, and no such aquatic growths had ever appeared in either of them. Unless Mr. Binnie had some special knowledge that the water in his reservoir would be affected in that way, seeing that it was in such an exposed condition, and free from contamination directly from Birkenhead or the district, he did not know that it was absolutely necessary that the reservoir should be covered. Of course, they knew that a reservoir that was not covered could certainly be constructed at from about a half to two-thirds of the cost of a covered reservoir. He would like to know why Mr. Binnie constructed a covered reservoir. Probably he had knowledge that the water would be subject to aquatic growths—if he had not that knowledge, then he (Mr. Priestley) did not know that it was necessary that in such a position the reservoir should be covered. With regard to the concrete, he was pleased to know that it was subject to the tests which the author had described. He had always understood that a sharp, siliceous sand was the best substance to use for concrete. The sand which was used in this work was not, so far as he could judge, either sharp or siliceous. There was one other point he would like to refer to, and that was in connection with the ventilation of the reservoir. It appeared to him that the ventilation was not sufficient. He did not know whether Mr. Binnie had yet had any proof on that point, but it appeared to him that very much more ventilation was necessary than was provided. He (the speaker) had a service reservoir somewhat similar, and they found that the air collected in the top, although there were several ventilators, and it was necessary to provide a great many more ventilators to get the air into circulation, or to clear it, than was put in in the first instance.

Mr. E. J. SILCOCK (Leeds) said he had not intended speaking on the paper, but he felt that one could not do less than thank Mr. Binnie for having brought forward that communication, and for having given them the opportunity of seeing the work in course of construction. The general design of the reservoir presented many novel features, and he had been very much struck with the very careful way in which all the details of the design had been worked out, and also the great care which had been exercised in the execution of the work. The general effect produced by the long columns, owing to the great depth, comparatively speaking, of the reservoir, was very pleasing indeed, and gave the structure almost an ecclesiastical character, which was rather novel for an engineering design. The design certainly reflected very great credit upon Mr. Binnie, and the nett result, from a cost point of view, seemed to be eminently satisfactory.

Mr. S. R. LOWCOCK (Westminster) said he thought they would all wish to congratulate Mr. Binnie on the very successful result of his work, especially as regarded the shape of the reservoir. The extreme accuracy with which it was enabled to be constructed was rather a feature for an hexagonal-shape building. The setting-out must have been done with extraordinary care to have got it over such a large area with such accuracy. The only point he wished to speak about was that of

"CHATTERING" CONCRETE.

He was very much interested in that, because he had been making some experiments himself, for another purpose altogether, and he quite endorsed Mr. Binnie's opinion that the difference in strength between ordinarily made concrete and this "chattering" concrete was certainly more than 6 per cent. His experiments had not been made on such a large mass as Mr. Binnie's. They were made on hexagonal blocks, something like 4 ft. 6 in. across. He did not know what their depth was. That was a very suitable size, for, of course, it was very much more easy to render the compact in the ordinary way than in a thinner slab. On the other hand, it was much more difficult to get a good "chattering" effect with that mass of concrete than it was with the finer slabs, and those were what he had been experimenting with. The concrete he had been using was rather fatter than was used in this case, because it was put on the sides of walls, and in good-sized chunks, and he found that the increase in strength was from 12 to 18 per cent. In some cases it was rather more than 18 per cent, due to the vibrating of the moulds in which the blocks were cast.

Mr. PRIESTLEY said he would like to ask Mr. Binnie whether anything was done to connect the two layers of concrete in the floor. He would like to know whether they were quite separate in construction, or whether they were connected to one another in any way. He found, in one instance, some time ago, in the floors of some filter-beds that the two layers of concrete were, after many years, quite separate, and were not homogeneous in any sense of the word.

Mr. H. ASHTON HILL (South Staffordshire) said he had not intended to speak on the paper, because the subject was one that did not lend itself very largely to discussion, but having been one of the party who visited the reservoir, through the kindness of Mr. Binnie, he would like to say a word or two on the

paper. One point he noted with interest was that at every period of the work Mr Binnie had an inspector, or a chemist, or some specialist testing the concrete used. He thought that was a very proper thing to do. Of course, some of them had had to construct a reservoir without having had that advantage. He thought they ought to have it. He thought that was

A FEATURE WORTH REMEMBERING,

and it showed the importance of works like that being done in that way. In constructing a reservoir they had to consider the varying conditions as to site and the materials they were going to use; and then, again, if they were in a mining district they had to consider the construction and the design to meet the situation. The reservoir constructed by Mr. Binnie struck him as being rather elaborate in design—it was a departure from the simple lines of circular or rectangular reservoir with a flat top, and one was inclined to criticise elaboration. When, however, one found that the cost came out so favourably criticism was disarmed and he had got nothing further to say about it. In regard to the tower which Mr. Binnie referred to in his paper, he presumed there was a self-closing valve on it to shut it off when it was full. Perhaps Mr. Binnie would tell them whether that was so or not. He (the speaker) knew the tower very well, and had been on it many years ago when he was engaged in that part of the country. Mr. Binnie spoke of the city of Birkenhead. In the days when he (Mr. Hill) was near there, and many years before, Birkenhead was always spoken of as a city of the future. He did not know whether it had become a city, or whether Mr. Binnie had been travelling in America recently, where they called every village a city. (Laughter.) The point mentioned by Mr. Priestley about open reservoirs was a very important one, and he would like to see it amplified. Mr. Binnie might be able to tell them something more about it. When they had a service reservoir he (Mr. Hill) thought a good deal depended upon whether they had an independent inlet pipe and an outlet pipe. In many cases there was only one single pipe for a considerable distance on the trunk main leading in and out of the reservoir. He thought such conditions were not good—there ought to be separate pipes to prevent the growth of algæ. Then, again, the difference in waters had to be considered. One water might vegetate under given conditions, where another would not. Of course, it was thoroughly understood that well waters and sandstone waters should have covered reservoirs. Mr. Binnie referred to a crack in the concrete about $\frac{1}{8}$ in. wide. He would like to know from the author whether, if he was going to construct another reservoir he would make one without that crack. The illustration which Mr. Binnie gave of the tests made in regard to the strength of a portion of the roof was an example of history repeating itself. It reminded him of the experience he had when constructing his first reservoir, now many years ago. He had specified that the roof should be formed of 16 by 6 girders, which had to stand 34 tons weight, he believed it was—that would be 17 tons in the centre. He placed the order with one of the chief, if not the chief, girder works in this country, and when he went to the works to see them put on the machine for testing, he found they had no machine for the purpose. Of course, tables of the safe loads of the girders were published, but there were no means of really testing them. It was winter time, and the contractors sent a locomotive and fetched several tons of pig iron, and they were going to test them by that means. When, however, they got about 7 tons of iron on to them, the whole thing began to tumble over, owing to the foundation giving, as the experiment was being carried out in an ash yard. He merely referred to that as an interesting illustration of history repeating itself. With regard to the price at which Mr. Binnie had constructed his reservoir, it certainly was a very moderate one per 1,000,000 gallons. At the same time, he thought the £5,000 mentioned for the London water companies was rather excessive.

Mr. Baker (visitor) said he was the resident engineer on the work, but he did not know that he could add much to what Mr. Binnie had told them, as that gentleman had pretty well covered the ground. There was just one point he might refer to, and that was the cost. He had got out the final figures for the

COST OF THE WORK.

He knew what it would be within a very few pounds, and it came well within the estimate. There was a considerable length of pipe line on the plans which really had nothing to do with the reservoir at all. As he had told Mr. Binnie, he should not include that in the cost of the reservoir, and the cost of that work amounted to over £2,000. If they deducted that he got a final figure of £73,500 as the cost, which came down to very nearly £2,500 per 1,000,000 gallons—which was even better than what Mr. Binnie had put forward. He (Mr. Baker) took over the work at the beginning of 1915, and the thought that struck him, and what had struck most people who had seen it, was the originality of the design. He had carried out works at various places, especially for large corporations, and in his view there had always been too much duplicating of designs. Because a service reservoir had been constructed, say, fifty years ago in one particular shape or design, if a new one was required it was very often built on similar lines. In this case the old designs had been departed from altogether. They had got something entirely original, and at a very much less cost than could have been obtained on the old lines. They all knew the definition of an engineer, according to the Institution of Civil Engineers, but he thought the definition that "an engineer is a man who will construct for 10s. what an ordinary man will do for £1" was sometimes preferable. In this case Mr. Binnie had showed that he had designed a service reservoir for about half what the old type would have cost. In addition to that there was the point which was so often raised by town councillors and people who visited waterworks—what was the good of spending money on a roof? Mr. Binnie, by adding the roof, had got a better job. It sounded curious, but it was a fact, the roof cheapened the work when they had got a covered service reservoir. He did not think it had been mentioned that the whole of the roof concrete had been machine mixed in a Ransome mixer, driven by a small 8-h.p. Lister engine, which had proved a great boon to the contractors in view of the scarcity of labour. They had an inspector on the job who was known to many of them, Mr. S. Ewart, who was quite converted to the merits of machine-mixed concrete. The bank of the reservoir had been constructed entirely of sand dug from the pit. It seemed at first as though the contractors were rather wasteful in their methods, as they shifted all the muck by carts, instead of employing a track or route. It cost the contractors a great deal more, but by the way in which the work had been done the bank was thoroughly consolidated by this carting, and they were very glad that the contractors had not adopted the modern means.

Mr. C. H. Roberts (Aberdeen) said he would like to join with the other speakers in saying that the institution was greatly indebted to Mr. Binnie for laying before them a description of such an interesting reservoir. He could not help but admire the boldness and the ingenuity of the design, and also the way in which the various problems in connection therewith had evidently been successfully dealt with. He had had the privilege of seeing the reservoir during a stage in its construction, and he had listened with very great interest to the reading of the paper, and more particularly because he himself had only recently completed the covering of three reservoirs and considerable alterations to another one, so that reservoir work was more or less somewhat new in his mind. He did not know that he could contribute any useful discussion to the paper, especially as he had hardly had time to read it through carefully before coming to the meeting, but he had noted one or two points which struck him as being of particular interest. The first point that struck him, looking at the genesis of the thing, was

THE SIZE OF THE RESERVOIR.

He noticed, in passing, that Mr. Binnie gave the figures 7,200,000 gallons per day, after allowing 3,600,000 gallons per day for the discharge of the compensation water into the river. Those, he believed were the same figures he gave some years ago for the drainage area. The late Mr. Dinkinson, of the Liverpool Engineering Society, gave a description of the works, and he (Mr. Roberts) looked the matter up before coming to the meeting as to what his figure was, and he was somewhat surprised to see that Mr. Binnie's figures were the same. He did not know how the original figure was obtained, but with later rainfall records of the district he should have thought there would have been a revision of the figure. The figure they had in the paper was for the yield of the river Alwen—7,200,000 gallons per day—and the size of the reservoir was given as 28,000,000 gallons. The reservoir itself, 28,000,000

gallons, was a very large one for a service reservoir. He did not know that there were many service reservoirs outside London that were so large as that in fact, as far as he knew, the Ambleyate reservoir was about the only one of similar size that he had any knowledge of, and that was about 27,000,000 gallons. The point that interested him was the size of the reservoir in relation to the size of the town and the supply. Mr. Binnie said that the Act provided for two service reservoirs of equal capacity each of 28,000,000 gallons. He presumed that the second one was not to be built until the waters of the river Brenig were impounded, and this reservoir which had been described was supposed to be dealing with the Alwen supply. Before he came to the meeting he looked up the waterworks directory to see what the reservoir capacity was at present in Birkenhead, and he found it was 7,000,000 gallons, so that meant a total capacity of 35,000,000 gallons, and the consumption of the town at present was 4,500,000 gallons per day, which gave them approximately eight days' supply in service reservoirs. Of course, if Birkenhead was to grow in size the consumption of water would increase. Mr. Ashton Hill had referred to various impressions as to Birkenhead growing into a city. Mr. Ashton Hill knew Liverpool, and so did he (Mr. Roberts), and the impression in Liverpool was that Birkenhead was going to increase at a very rapid rate. Taking the larger quantity of 7,000,000 gallons a day for, of course, he supposed, although he did not know, that a portion was to go to supply authorities on the route—the consumption under this scheme would never be consumed in Birkenhead. Looking at the matter in that way, he could not help thinking that the reservoir was rather large in size. He did not know whether Mr. Binnie had considered the making of the reservoir in two parts or putting a dividing wall into it. He (the speaker) had had no experience of the water, but he should fancy, especially after being filtered, it would be comparatively clear; but the service reservoir would need cleaning and repairing, and the effect of taking it off would reduce the capacity in the town by 80 per cent. On the question of asphalt, he would like to say that a case came to his notice where the pillars were placed on asphalt, and the asphalt allowed the pillars to slide. In the case of another reservoir, built on the same lines, the pillars were let into the floor, and the asphalt also let in the floor. The main drain surrounding the reservoir, which took up the roof drainage, was a very interesting and very novel method in connection with service reservoirs. The author's description of the pillars was very interesting. He told them that the top and bottom edges were chamfered. If there was any deposit in the water the bottom chamfered formed a lodgment for deposit, and he should think that would be very difficult to clean. In regard to the question of cost, he was surprised to hear Mr. Baker refer to the average cost as being £5,000 per 1,000,000 gallons. That had often been referred to as the cost of service reservoirs. He presumed that when Mr. Binnie in the paper referred to the cost of the reservoirs of the London water companies, he had in mind Mr. Morris's papers on service reservoirs. He did not know whether that was so or not. Mr. Morris wrote two papers, one in 1885 and one recently, describing reservoirs which he built at a cost of £5,000 per 1,000,000 gallons. Those reservoirs were all small reservoirs—a great many of them under 1,000,000 gallons; £5,000 per 1,000,000 gallons for a large reservoir would be an exceedingly excessive cost, and he hardly thought it was fair to use that figure in comparing the actual cost of the work they were now considering.

(To be continued.)

Exeter War Bonus.—With reference to the paragraph under this heading in our issue of last week, Mr. Thomas Moulding, the city surveyor of Exeter, writes: "The war bonus decided to be paid by my council was—1d. per hour to all hourly men, and 2s. 6d. per week to weekly men, to a limit of 30s. per week. The penny per hour accounts for more than half the total cost."

Disposal of Nightsoil.—Referring at the last meeting of Bridlington Town Council to the farming operations of the Sanitary Committee, Alderman Hill said that last year they were paying £540 for the removal of nightsoil by motor traction, but eventually they rented land in Bempton-lane, saved the cost of the contract, and, by growing oats, wheat, and hay, provided food for their horses and made a profit of £191.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάντ' ὁρᾷ

(One man does not see everything.)

—Euripides.

CONCRETE ROADS.

To the Editor of The Surveyor.

Sir,—With regard to the short article I wrote in your columns a few weeks ago upon the above subject, and the subsequent correspondence on the matter, my thanks are due to Mr. Matthews Jones, of Chester, and Mr. Hutton, of Exmouth, for their support of my contention that such roads, properly made, should have a further trial in this country. They also added much that is of interest in studying this method of construction.

With regard to the letter from "Concretor," which appeared in your issue of the 8th inst., in which exception was taken to such construction, I should be greatly obliged to him if he could inform me where his test road which required considerable repairs after only four years of wear was laid, and furnish details of the manner in which it was constructed. There can be no doubt that up to now there have been many failures in this method of construction in this country, but there must be some reason for these failures when we know that in the United States of America such roads have now passed the experimental stage and many millions of yards have been successfully constructed.

With reference to "Aberdon's" complaint of the difficulty of repairing the trenches opened for gas, water, and similar purposes, with roads of this description, we all know the bugbear this is to all road engineers, and how difficult it is to keep a "respectable" road under such conditions. I do not think, however, that the reinstatement of such trenches with concrete would be more difficult than with other descriptions of road construction, but I agree that much more care would have to be exercised in such reinstatements than is generally practised by gas or water companies, or other "independent" individuals who have powers to break up our roads and streets.

I agree that most careful watching would be necessary in the case of concrete roads, but the remedy would be to obtain powers from the corporation or district council or whatever the road authority might be, to make all reinstatements with their own staff, and charge the cost, whatever it might be, on the parties responsible for opening the road for any specific purpose.

"Concretor" goes on to say that, after long and careful trial, he has abandoned concrete in favour of tar-macadam, which he says costs about the same and is easily repaired, but he does not say whether, in his opinion, a well-built concrete road would have a longer, or shorter, life than a tar-macadam road, and this is, of course, a very important factor in dealing with the question. I do not wish to be misunderstood in my advocacy for further trials of concrete as a road material, in place of bituminously bound roads. There is plenty of room for both, but what I do wish to advocate is that, in view of the remarkable success with concrete road construction in America, we in this country should not be behind in any progress that is possible, and should endeavour to find out why such a form of construction in this country has hitherto been so much out of favour, and that there should have been so many failures in this direction.—Yours, &c.,

H. Percy Boulnois.

34 Evelyn-mansions,
Westminster, S.W.
December 11, 1916.

To the Editor of The Surveyor.

Sir,—I see in your issue of The Surveyor, dated December 8th, a letter signed by "Concretor" with reference to concrete roads, in which he refers to certain roads which have been constructed of concrete and have become corrugated after a certain time, others also showing signs of wear.

Would your correspondent please oblige by letting engineers and surveyors who are interested in this class of work know whether such concrete surfaces were tar-sprayed or not, as I cannot understand myself how concrete after four years should become corrugated.

With regard to the difficulty of making good streets so far as expense is concerned, fortunately for the corporation of Chester we do all making good of

street surfaces but the electricity, water and gas companies, as well as all private contractors, and if such concrete roads have to be made good, such companies or contractors would have to pay the cost of the work.—Yours, &c.,

W. Matthews Jones,
City Surveyor, Chester.

December 8, 1916.

SURVEYORS AND MILITARY SERVICE.

To the Editor of The Surveyor

Sir,—I agree with your contributor of "Things One Would Like to Know" that it is not fair for a writer of a letter in the correspondence columns of a contemporary to suggest that the large number of surveyors who are now offering themselves for service in France on road construction should have offered themselves before for military service.

In my particular case I applied to my council to be relieved of my duties here, but permission was unanimously refused. Further, I refused to apply for exemption, with the result that exemption was not for me by the town clerk direct from the military authorities.

I have now offered my services to Brigadier-General Maybury and if he accepts them I shall, in all probability, with or without the consent of my council, accept a position under him, as I feel the time has come when every one who can must do all in their power to push this war to a complete and glorious finish.

I would like to state for the benefit of the writer of the letter that after my application had been before the council, the four assistants I had in my office all of whom were of military age, applied to me for permission to join up with the Colours, which I (being a patriotic person) gave them. I am now doing the work of my office, which, of course, is considerably less, as the various committees are not proceeding with any large works; nevertheless, I am carrying on here without any assistants. Not only have my assistants left, but my roads foreman also has gone, and I am carrying on his duties as well as those of the others already referred to.

I feel convinced if inquiries were made it would be found that at least 75 per cent of engineers and surveyors of borough and urban districts who were of military age have offered their services at one time or the other, but have been refused permission by their councils to join up.

I think it is only fair that some information should be given, and have pleasure in subscribing myself,—Yours, &c.,

A Constant Reader.

December 8, 1916.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: NOMINATIONS FOR COUNCIL, 1917-18.

To the Editor of The Surveyor

Sir,—The attention of members and associate-members of the Institution of Municipal and County Engineers is directed to By-law 14, and particularly to the following portions thereof:—

". . . Each member or associate-member of the institution shall be at liberty to nominate one member or associate member for the council. . . Members' or associate-members' nominations must be received by the secretary not later than February 1st in each year, and must be accompanied by the written consent of the nominee. . . ."

It should also be noted under the provisions of By-law 10 no ballot list will be sent to any member or associate-member whose subscription for the year commenced May 1, 1916, remains unpaid.—Yours, &c.,

Mildred B. Robinson,
Acting Secretary.

December 13, 1916.

Devon County Sanatorium.—A sanatorium built by the Devon County Council at Hawkmoor for the treatment of tuberculosis patients was formally opened on Tuesday last. It is the first institution of its kind under the Insurance Act, and contains accommodation for eighty adult patients and fifty beds for children. The cost of the building will be about £15,000, and the furnishing about £1,500, the total cost, including the purchase of the property, working out at an estimated average of £200 per bed. The plans were prepared and the building supervised by Messrs. Ellis, Son, & Bowden, of Exeter.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Would not the house refuse problem be speedily settled if everyone were to follow the example of Councillor Johnston, of Manchester, who, according to the *Manchester Guardian*, puts all the useless organic matter, as well as scrap-paper, &c., on the kitchen fire, the ashes being screened, and the cinders reused on the fire, while the fine ash—of which there is only a very small quantity—is used on his garden paths or for other purposes?

* * * *

Is not the Mayor of Tynemouth to be congratulated on the brave and manly speech which he made in returning thanks for his re-election for the fourth year in succession the other day? Was he not right when he said that men ought to be sent to the council for their approved aptitude for public service, and not be chosen for Church or party purposes; that the aim should be a standard of lofty-souled citizenship, free from the blight of intemperance, immorality and crime all of which, he said, were intimately associated with bad housing? Would it not be a good thing for this country if all our councillors were imbued with such high ideals?

* * * *

Was not the paper on "Sanitation with the British Expeditionary Force in France," which was given by Lance-Corporal N. W. Hoskins at the sessional meeting of the Institution of Sanitary Engineers the other night, one of extreme interest, as showing the devoted self-sacrifice of the officers and men of the Sanitary Corps, which have done so much to improve the condition of camps, billets, and trenches at the Front? Why should not all conscientious objectors clamour to be taken into this life-saving organisation? Is it that their conscience only permits them to take extreme care of their own lives?

* * * *

Is it not interesting to read that in America there are to be a number of scientific investigations with regard to the formation of cracks in concrete roads, with a view to finding a remedy for the trouble? Is it a fact that one of the theories with regard to some of these cracks is that they are due to the action of frost in the soil under the concrete first causing a movement through expansion of the soil, and then, when thaw ensues, a settlement, owing to the subsequent contraction? Is it not to be hoped that these experiments will throw some light on the problem and ultimately lead to a solution?

* * * *

How many conscientious objectors are now being employed in road making? Could not a greater use be made of their services than at present obtains? Are there conscientious objections against employing these men? If this is so—and one can quite understand it—does not the present dearth of labour make one think of the adage, "Needs must when the devil drives"?

* * * *

Are not editors of newspapers very fond of using the phrase, "what we have persistently advocated," when any reform which they have agitated for is finally taken up? Should not the writer of these notes be tempted to follow their example when he finds that Sir Philip Magnus asked the other day in the House of Commons whether the President of the Board of Trade "would take steps to lessen the number of dogs which now prowl about in London and in other cities," and drew attention to the unhygienic condition of the pavements caused by these dogs? Have we not constantly drawn attention to this nuisance and the selfishness of people who keep dogs in cities?

* * * *

Was not the "Safety First" conference at the Caxton Hall the other day extremely interesting, and were not many excellent suggestions made for minimising the risks run by pedestrians when crossing the streets? Has not, however, mechanical traction come to stay, and is not the whole question summed up in the modern application of the words, "the quick and the dead"? Are not the "quick" those who get out of the way, and the "dead" those who don't?

An Inquiry.—A surveyor to an urban district council asks for the addresses of firms dealing with the Williams patent crusher and the Carr disintegrator.

British De-Tinning Company's Scheme.

CONFERENCE OF MUNICIPAL AUTHORITIES.

From time to time during the past few months we have drawn attention in our columns to the important proposals of the British De-Tinning Company, who are seeking the support of municipal authorities and their engineering officials to a scheme by which those bodies would be enabled to dispose of their accumulations of waste tins with more advantage to themselves than was the case in pre-war days, when the bulk of this discarded metal was shipped to Germany for treatment and re-use. The company have two powerful pleas to urge, the first being that by the adoption of their scheme much waste will be avoided, and the second being that they are out to capture what has for years been a lucrative business for the Germans. With the view of bringing the proposals more closely to the attention of local authorities, a conference is being held this week at Caxton Hall, Westminster, and at the opening sitting on Wednesday there was quite a good attendance of delegates, largely composed of municipal engineers, several of whom put searching questions to the promoter of the company on various aspects of the scheme.

Mr. Henry Cust, chairman of the Central Committee for National Patriotic Organisations, who presided, said he desired first of all to make it clear that neither he nor his association had the slightest financial interest in the matter. His committee approached the subject purely from the economic point of view. If the wealth of the country was to be increased, they had not only to increase production, but also to prevent waste. His committee made inquiries into the question of old tins, and were referred to a firm in London which had been in the habit of buying old tins from English municipalities and from the Colonies. He need hardly say it was a German company, and the tins were sent to Essen. Investigation showed that, while large profits were made by the Essen company, apparently no profit was made by the company operating in England, and, moreover, the secret of the process was not known in this country. A similar company operated at Coatbridge, under, it was believed, the same auspices. Several municipalities had informed his committee that they were themselves de-tinning, but he believed the product obtained was not particularly suitable to the smelters of the country. They learned that several municipalities had entered into arrangements of a somewhat different character with the British De-Tinning Company. The National Committee felt that this was a work which must be associated with the municipal authorities of the country, and, further, that there should be a safeguard that it should remain a British industry, and they had obtained a statutory declaration from Mr. Morgan Jones in this respect. The chairman made a strong appeal to his hearers to do all in their power to prevent the waste of materials in the future, which he said had been a disgrace to the country in the past.

Mr. Morgan L. Jones (the promoter of the British De-Tinning Company) said he was present as a plain business man with a plain business proposition of national importance. The war had brought it home to them that, as a nation, they had lacked enterprise in many directions. He was in a position to prove that for years they had practically made Germany a present of many materials, and he was in possession of the various processes by which Germans transformed old tins into valuable metal and manufactured goods. With the aid of the municipal authorities of the country they could capture that trade. Mr. Jones proceeded to review briefly the history of the tin-plate trade of this country, and described the various processes of manufacture. It took about a fortnight to manufacture a new tin-plate, whereas by his process good metal could be produced in twenty-four hours. At the lowest estimate Germany had taken 30,000 tons of old tins from this country annually, at an average cost of £1 per ton. The pre-war price of the actual tin they extracted was £150 a ton, and solder was to-day worth 1s. 9d. per lb. The Germans returned these old tins to them in the shape of the toys and cheap metal articles. Mr. Jones illustrated his point by showing how he had dealt with an old pineapple tin and utilised a portion of it in forming a plate for a child's coffin—an article which Germany exported freely. His process was quite original, and the company had taken nothing from Germany. They did not want the tins pressed by hydraulic machinery; they wanted them cut into strips, and they had suitable machinery to deal with that. The speaker showed his audience how the tins should be cut. If, for instance, galvanised buckets were cut in the way he referred to they could get something like £5 a ton for them. The company had got all the funds it required to start business, and they proposed to employ partially disabled soldiers. They proposed to lay down a modern works in London, and they would welcome the appointment of a committee of borough engineers to go through it. If they were satisfied with the works, any municipality in the country could copy the process, provided always they paid a royalty per ton. He had tried every department in Whitehall, and they had "turned it down." Several wealthy commercial firms were prepared to finance it, but he preferred to come to the municipal engineers, who were the men who had the material.

Mr. R. Brown (Southall-Norwood) urged that the local authorities of the country must force the hands of the Government so as to enable such authorities to recover something from the waste they had to deal with. They were empowered to erect destructors and to make slabs from clinker, but when they asked to be allowed to sell their productions they were told there was no statutory authority to enable them to do so. If they could recover the used tins and transform them into some of the articles to which reference had been made, then it seemed to him to be a good proposition. What Mr. Jones was asking of them was to support him in appealing to the Treasury to be allowed to go forward and put up his works at Southwark, with the express object of showing local authorities what was being wasted at the present time.

Questioned by a delegate, Mr. Jones said the company had secrets, and was capable of doing as well, or better, than the Germans, provided they could get consent from the Treasury to issue shares. If they could get this consent, and also consent from the Ministry of Munitions to put up works, they were prepared to go right ahead and put down the plant.

The delegate: Would that be an experimental plant to show that you are in possession of the secret?

Mr. Jones: We propose to put down works at a cost of £12,000 to start with. In that works we would not only be de-tinning, but manufacturing completely. We would turn out something like 30 to 100 tons per week if necessary—that is, finished goods. We do not pay much attention to de-tinning only. Taking the tin off merely for the purpose of claiming the tin would not pay. To take off the tin for the purpose of getting at the base metal would pay.

Questioned further, Mr. Jones said they did not propose to ask municipal authorities to risk a farthing. The company would put down the works and local authorities could copy anything, provided they paid a royalty. They were also prepared to enter into contracts with local authorities for the purchase of materials at a higher price than the Germans purchased them at, and give them the option to take up the process themselves at any time on payment of a royalty.

Mr. W. Osborne Thorp (Malvern) asked how small towns a long distance from London were to send up the tins without crushing them—the cost of carriage would be prohibitive.

Mr. Jones said the company would provide the machine for cutting the metal into strips. Such a machine would cost about £50, but probably the company would let them out on hire.

A number of further questions were put, but the chairman pointed out the impossibility of answering them off-hand, and he suggested that they should be dealt with on the following day.

This course was agreed to.

At yesterday's sitting of the conference a resolution was adopted approving of the proposition outlined on behalf of Mr. Jones, subject to the final report of a special supervisory committee, and agreeing that on a favourable report being received from the committee to recommend the local authorities represented to

The Surveyor
And Municipal and County Engineer.

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enter into an agreement with Mr. Jones on the lines indicated for the purchase of their waste metals for a term of years and from year to year until determined by notice to be fixed.

Mr. C. T. Rathen, speaking on behalf of Mr. Jones, further elaborated the suggestions made by the company, and replied at considerable length to the numerous questions put by the delegates in the course of the proceedings. A full report will appear in our next issue.

MUNICIPAL SCHEMES AFTER THE WAR.

CHISWICK U.D.C.—The following is a list of works that the council propose to carry out after the war, but it is doubtful if all will be completed for several years, owing to the probable serious increase in the cost of materials and labour: (1) The erection of a new wharf, retaining walls, locomotive crane, and portable railway, at or near the river depot; (2) the provision of a river embankment, and promenade 100 ft. wide, from the present sewage disposal works at Chiswick, to the Polytechnic boat-house, at Grove Park, including a sunken portable railway for conveying raw materials to factories, and raised tennis courts, and gardens facing the river; (3) the provision and laying-out of a pleasure and recreation ground at Strand-on-the-Green; (4) the removal of the present old properties adjoining Kew Bridge and the provision of a new approach road to Strand-on-the-Green and Kew draw-dock; (5) the wood paving of Heathfield-terrace, and Wellesley-road to form a by-pass to the Great Western road; (6) the wood paving of Turnham Green-terrace, to link up the wood paving of Bath-road with Chiswick High-road; (7) the improvement and widening of Sutton-lane, for which Parliamentary powers have already been obtained; (8) the general improvement and widening of Strand-on-the-Green, for which various properties have already been purchased; (9) the laying out and completion of the existing burial ground; (10) the erection of motor-wagon shops and facilities for the changing of different bodies.

DONCASTER T.C.—The Highways Committee report that it will be necessary to proceed with— (1) Street works included in the Doncaster Corporation Act, 1913, at an estimated cost of £50,000; (2) street works not yet carried out in St. Sepulchre Gate, at an estimated cost of £40,000; and (3) other street works in Scott-lane and other scheduled sites not yet dealt with, at an estimated cost of £10,000—making a total estimated capital expenditure of £100,000. The Sewage Disposal Committee have also resolved, after the war, to proceed with a sewerage scheme, at an estimated cost of £100,000, and with the extension of the destructor, at an estimated cost of £10,000.

RUGELEY U.D.C.—The proposed works include the building of fifty working-class houses, at an estimated cost of £12,500.

WOKING U.D.C.—It is intended after the war to carry out about twenty road-widening schemes.

STREET CLEANSING IN MANCHESTER.

A WOMEN'S DEPUTATION MAKES SUGGESTIONS.

The Cleansing Committee of the Manchester City Council on Monday received a deputation from the Manchester and Salford Women Citizens' Association, who made the following suggestions for the better care of the streets during the present shortage of labour: (1) The diversion of labour from the cleaner to the dirtier and more crowded areas; (2) the employment of women in place of the men who have enlisted in all ranks of the cleansing service; (3) the watering of streets before sweeping in dry weather; (4) the use of covered dustbins and the earlier emptying of ashbins; (5) closer supervision of scavenging work, in order to ensure that this is efficiently done, and more frequent inspection of grids and entries; (6) orderly baskets in all streets; (7) the rigid enforcement of the paragraph in section 102 of the Manchester Police Act, which deals with the depositing of refuse in the streets. Daily visits of cleansing gangs in all streets where the discharge of factory refuse into the street is not preventable; (8) the repair, with the least possible delay, of road surfaces in the poorer districts.

Mrs. E. D. Simon, in putting the views of the deputation before the committee, said that women had been employed successfully on street cleansing in other cities, where they had taken the place of men now in the Army. She pointed out that the state of the streets affected the public health, and urged that more attention should be given to the poor and populous neighbourhoods even if it should be at the expense of the more prosperous ones.

Mrs. Unwin said that waste places where dwellings had been pulled down and areas of unoccupied houses were sources of street dirt, and she asked whether steps could not be taken to deal with such places as a nuisance.

Mrs. Wiseman said that in such districts as Hulme street sweeping once a week was not sufficient. Quantities of dust on dry days blew into the houses.

Mrs. Cox said that many complaints had been received of the sweeping of shop refuse into the streets. She asked if this could not be dealt with by prosecution.

It is understood (the *Manchester Guardian* states) that the committee are not disposed to employ women on street cleansing.

Women willing to work as "roadmen" are being offered £1 a week wages by the Buckley, Flintshire, Urban District Council.

The Purification of Rivers.—Presiding at a meeting of the Thames Conservancy Board on Monday, Lord Desborough, referring to the report of the River Purification Committee, commented on the Bill which proposed to place the control of the rivers in the hands of the Railways and Canals Commissioners. He had opposed the Bill successfully in the House of Lords on the ground that the commissioners had no practical experience. The Thames was the concern of that board, and it was to be remembered that its water formed the drinking supply of 6,000,000 Londoners. The board could now take legal steps against offenders. He learned that several of the rivers in the upper reaches had been so polluted that their waters even corroded boilers and destroyed machinery. Progress in purification had been put back twenty years. Before damage could be shown it would be necessary to prove death from the contamination. What the conservators of the Thames desired was to prevent death—not to take action afterwards. The Bill had been postponed owing to the Parliamentary crisis. It was resolved, on Lord Desborough's suggestion, to hold an informal meeting of the Parliamentary and Purification Committees, after the conclusion of the routine business, to discuss the matter.

Sanitation with the British Expeditionary Force in France.*

By N. W. HOSKINS.

(Conclusion.)

In town areas the civil and military authorities often combine to remove the refuse and existing accumulations.

All refuse from billets is put into suitable movable receptacles for emptying into carts. A suitable dumping ground is found outside the town area. Brick incinerators are built, preferably on the improved beehive principle. (Fig. 11.) The refuse is

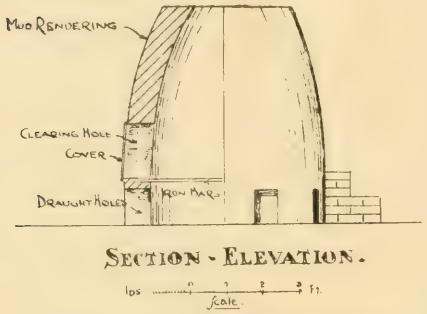


FIG. 11.—IMPROVED BEEHIVE INCINERATOR.

collected daily by a cart and dumped near the incinerator, where there is a man in constant attendance.

EXCRETA BURNING.

Where the excreta are burnt with the refuse it is essential to use closed incinerators in order to obtain sufficient heat effectually to carbonise the excreta. A most satisfactory form for this purpose is the improved beehive incinerator. (Fig. 11.) The ordinary beehive is built, but is carried up to a height of about 6 ft., the brickwork being oversailed to re-

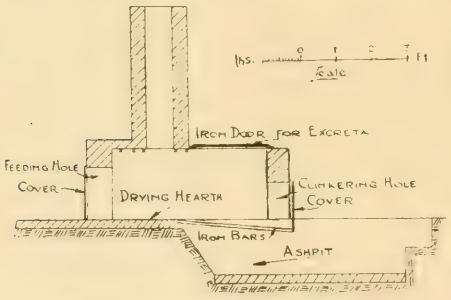


FIG. 12.—INCINERATOR FOR A SMALL TOWN

duce the diameter to 18 in. or 2 ft. at the top. An opening is left at the height of the bars for clearing. The incinerator is fed from the top, the excreta being well mixed with the refuse. It is being used with great success for burning excreta with no other fuel than the ordinary refuse.

A small experimental incinerator was built on the lines of a back-feed town incinerator to deal with refuse and excreta. (Fig. 12.) It has several advantages. The refuse is dumped and fed into the incinerator at ground level, whereas in other forms it has to be lifted from 4 ft. to 6 ft. The burnt refuse is removed without interfering with the burning surface, and it is provided with a drying hearth which effectually dries the second load while the first is burning.

The fault found with this incinerator is that it is not as simple to construct as other forms.

A small square incinerator (Fig. 13) has been used with fair success for burning the excreta of small numbers of men. The excreta mixed with a little refuse is put into a perforated iron cresol drum which is placed in the centre of the incinerator. Fuel in the form of dry brushwood, refuse, &c., is burnt around it.

Fig. 14 shows a portable incinerator made of sheet-iron.

DISPOSAL OF SULLAGE WATER, ETC.

Sullage and greasy water from kitchens is run into specially constructed pits after passing through an improvised grease trap (Fig. 15). The pit, which is about 4 ft. deep, is constructed on exactly the same lines as a soakage urinal. The grease trap (Fig. 15)

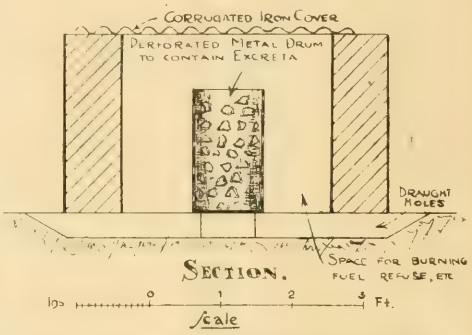


FIG. 13.—INCINERATOR FOR CARBONISING EXCRETA.

is made from a biscuit tin perforated at the bottom and half filled with straw. The straw collects the grease, tea leaves, &c., and is removed daily and burned in the incinerator.

Ablution water is dealt with in the same way, unless there is a stream close by into which it may be passed after being run through a grease trap (Fig. 16).

WATER SUPPLY.

An adequate supply of good water is absolutely essential for man and beast. This is often a diffi-

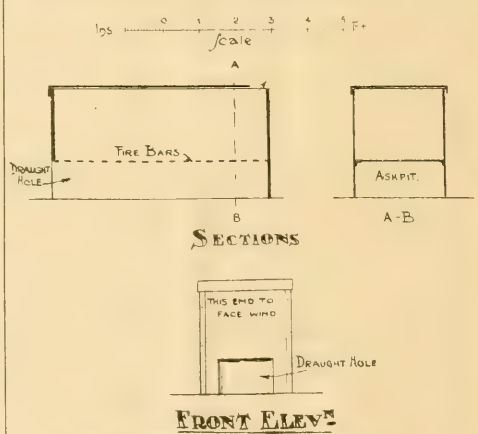


FIG. 14. PORTABLE IRON INCINERATOR.

cult matter, as there is no very elaborate apparatus with which to test and purify it.

When choosing a supply, common sense is the most important guide as to whether the water is suitable for the required purpose. The general surround-

* Paper read on Wednesday, the 6th inst., at a meeting of the Institution of Sanitary Engineers.

rags, colour, smell, &c., give a rough idea as to the quality.

There is one very rough test which an Army officer informed us was used by our men in the South African War. Anything suspected of being water was put into a bucket. If it came out when the bucket was turned upside down it was water, if it did not it

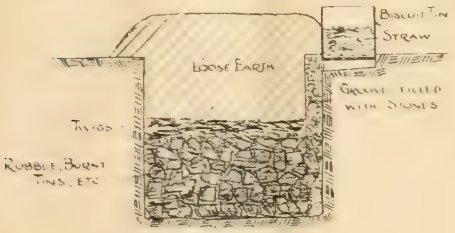


FIG. 15.—GREASE TRAP.

was mud. I do not think it has been necessary to resort to this test during the present campaign.

Water for drinking and cooking is obtained from shallow, deep or artesian wells or springs. It is distributed by means of water carts having a capacity of 110 gallons, which are fitted with a sterilising apparatus. No water is considered safe for drinking without treatment, and medical officers are instructed to see that none but purified water is issued to troops, and that the water duty *personnel* know how to work the carts and keep them clean.

The chloride of lime method of purification is in general use, the old pattern candle filter carts being

FIG. 16.—GREASE TRAP FOR ABLUTION WATER.

replaced by carts fitted with Colonel Horrocks' steriliser (Fig. 17). Alum and chloride of lime (bleaching powder) in the proportion of 2 to 1 are used for purification, the alum acting as a precipitating agent.

Fig. 17 shows this apparatus for pack carriage. It consists of a galvanised iron cylinder (A), inside which is a canvas filter supported by a wire cage (B), and at one end a container for the chemicals (C). A small pump (D) raises the water from the source of supply (E) and forces it through the chemicals, which are held in the container by means of wire gauze.

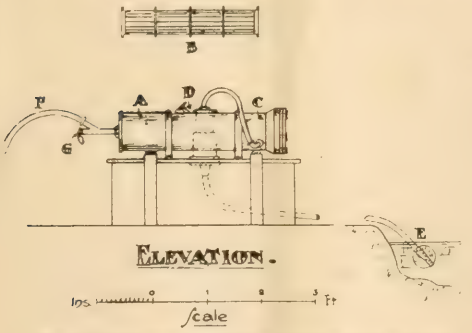


FIG. 17.—COLONEL HORROCKS' WATER STERILISER.

It dissolves sufficient of the alum and chloride of lime to precipitate solids in suspension and purify the water. It then passes through the canvas filter, consisting of three layers of finely woven canvas, and out by the delivery pipe (F). The first 2 gallons are run to waste by an auxiliary pipe (G).

This apparatus is capable of purifying 180 gallons of water per hour, and is re-charged with chemicals for every 100 gallons. The water is exposed in the cart for from half to two hours after purification as the process gives a slight taste of chlorine to the water, which, however, quickly disappears on exposure to the air.

If the water cart is not fitted with Colonel Horrocks' apparatus, a simple test apparatus is used which indicates the amount of chloride of lime to use. This

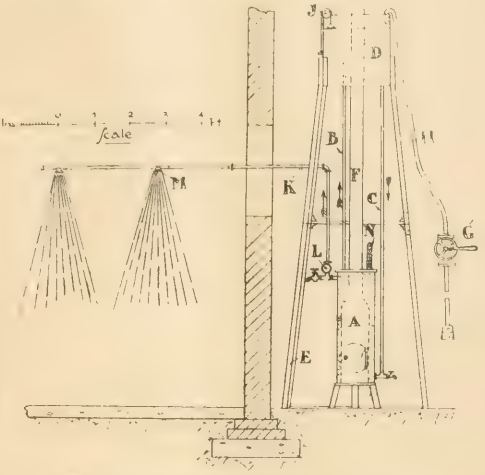


FIG. 18.—PORTABLE HOT-SPRAY BATH.

test is based on the amount of nitrates found in the water, and assumes that their presence indicates organic pollution.

When it is impossible to supply water purified by this method, acid sulphate of soda tabloids are issued to the men; one tabloid is sufficient to sterilise the contents of a regulation army water-bottle.

In small and detached units it is often the practice to supply boiled water for filling the water-bottles.

For men in the trenches it is impossible to take the carts very close to the firing line, owing to the noise of the carts attracting the enemy's fire. Rum jars,

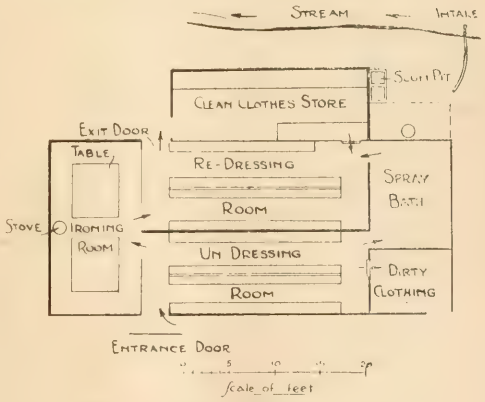


FIG. 19.—PLAN OF BATH-HOUSE.

petrol cans, or barrels are used to store the purified water. Great care has to be exercised to keep these vessels clean.

PERSONAL CLEANLINESS.

Vermin.—Every means is used to exterminate vermin from troops. Body lice being the chief offenders, frequent baths and change of underclothing, disinfection of clothes and blankets, frequent change of straw in billets, and the free use of anti-vermin preparations, such as N.C.I. powder, Vermijelli, &c., are the chief precautions.

Baths.—It is arranged for every man to have a bath at least once a week. At first tubs were used, these being installed in factories where waste steam was

available for heating the water. The hot water was run to a vat and the tubs filled by means of pails. A second vat contained lukewarm water to enable the bather to take a plunge after washing. The tubs were scrubbed out with cresol solution every evening.

A spray apparatus is now used which folds up into a very small space and which can be fixed up or dismantled in about half an hour.

The accommodation required is generally not difficult to find, but in some cases wooden huts are built by the Royal Engineers. A stone or brick floored apartment about 12 ft. by 8 ft. is required for the sprays, rooms for dressing and undressing with seats and hooks for clothes, underclothing store, and ironing room. As a good supply of water is necessary, the site is chosen near a stream, &c.

The spray apparatus (Fig. 18) consists of a small boiler (A) connected by flow and return pipes (B, C) to a cistern (D), supported at a height of 11 ft. above ground level by an iron tripod (E), and having a capacity of 26 gallons. The flue (F) from the boiler fire is taken through the cistern to utilise the waste heat. The level of water in the cistern is maintained by means of a small semi-rotary pump (G) which raises water from the source of supply and forces it through the supply hose (H). A float gauge (J) indicates the level of the water in the cistern. The supply pipe to sprays (K) is taken from the top of the boiler, and has a control valve (L), and when turned on the hot water from the boiler is forced along the pipe (K) to spray nozzles (M) by the head of water in the cistern. A thermometer (N) is fixed on top of the boiler to ensure the water being of even temperature. Included with the apparatus are wooden foot-rests to cover the floor under the sprays. The whole folds up into five small crates.

It takes about fifteen minutes to heat the water, and the average quantity used is about 1½ gallons per man.

One spray bath is capable of bathing from 600 to 800 men a day if their clothes are being ironed, and about 1,000 men per day otherwise.

The bathing is arranged as follows (Fig. 19):—

The first batch of men enter the undressing-room and hang their clothes on numbered pegs. They leave their soiled underclothing in an apartment or in boxes for that purpose and enter the bath-room, where they wash with soap under the hot-water sprays. While they are washing their clothes are removed from the undressing-room to the ironing-room, where the seams of tunics and trousers are cresoled and ironed with hot irons. After ironing, the clothes are taken to the dressing-room and hung on pegs with numbers corresponding to those in the undressing-room. On the way from the bath-room to the dressing-room the men are issued with clean underclothing. In the meantime the second batch is undressing.

The soiled underclothing is steam disinfected, taken to laundries, washed and re-issued. There are four bath-houses for the division, one for each brigade and one for divisional artillery.

DISINFECTION.

A double Thresh disinfector mounted on a Foden steam lorry is attached for disinfecting clothing, &c., and all blankets are disinfected at regular intervals.

INFECTIOUS DISEASES.

All cases of infectious disease are reported to the Divisional Sanitary Officer. Full details of the case are obtained and records kept, special attention being paid to the sources of infection, including carriers and its connection with other cases.

The billet last occupied by the patient is thoroughly disinfected. All straw is removed and the quarters sprayed with a solution of Formaldehyde—8 fluid ounces of formalin solution with a gallon of water. This solution is applied by means of Mackenzie sprays, 1 gallon covering about 400 sq. ft. If practicable, the floors and walls are painted with disinfectants.

Blankets of "contacts" and patients' clothes, &c., are steam disinfected, and in some cases the billet is put "out of bounds" to troops and the contacts isolated.

Infectious disease among civilians is also investigated, and dealt with on the above lines. A record of cases with addresses is kept and handed over from division to division to prevent men being billeted in these houses.

Other drawings illustrating some of the appliances and apparatus mentioned in the foregoing paper are on file at the offices of the Institution of Sanitary Engineers, and can be seen on application.

At the meeting of the Institution of Sanitary Engineers, at which the foregoing paper was read, a vote of thanks to the author was proposed by Major Goddard—the father of the Sanitary Companies, as Major A. J. Martin, the chairman, took occasion to point out in inviting discussion. Every division of the Army, said Major Goddard, had now attached to it one of these sanitary sections, and the splendid men who composed them, taken from every walk of life, had gone through the greatest hardships in the performance of their duties. In dealing with incinerators, the writer of the paper had dwelt chiefly on the beehive type. There were many different types which were accepted, but the kind of incinerator adopted depended very much on the situation in which it had to be installed. Within 2 miles of the trenches, where the lighting of a fire was not permissible, the more primitive method of earth burial had to be followed, but further back, at the rest billets and at the bases, with access to brickwork, one could put up most elaborate installations.

Captain Carson, in seconding the vote of thanks, remarked that one of the greatest difficulties at the Front was the lack of material for the provision of sanitary appliances, and the paper showed how it was possible with the application of a few elementary principles of engineering to improvise the little that was available.

Mr. H. Percy Boulnois, supporting the vote of thanks, said he could remember the Crimean War, in which, of course, the mortality from sickness was enormous. Sir Robert Rawlinson, who afterwards became the chief engineer to the Local Government Board, used to relate how, when he was sent out to look into the sanitary affairs of the Army, the first thing he did when he went to the hospital in Scutari was to push a stick through the windows. Our present Army was extremely fortunate in having such a corps as that represented by the Sanitary Companies to look after them. Necessity was the mother of invention, and the paper which had been read that evening bristled with descriptions of useful appliances made out of practically waste products.

Mr. J. H. Blizard made an appreciative reference to the practical way in which the author had put his experiences before the meeting. It seemed to him that, in spite of the peculiar conditions under which work was carried on there, the men engaged at the Front were a thousand times better off than even in the old Volunteer camp days.

The Chairman observed that the work of the sanitary sections was not only of enormous benefit to the health of the troops, but contributed in no small degree to their comfort. The bathing arrangements were alone a great boon to the men. All present must have been impressed with the great range of work that was done by the corps, and he had no doubt that the author, if called upon, could write another paper just as long as the one that had been read that evening without touching upon a single point already dealt with. Two years ago they were recruiting for the Sanitary Companies, and he would like to take the opportunity of saying how much he was indebted to the Institution of Sanitary Engineers for the many splendid recruits they got through it. In those early days many of them were exercised in their minds as to the use that was going to be made of the men. Many of them were afraid that these highly qualified men were going to be sent out to do navvies' work, though in pointing out that the work in which they were engaged was of a scientific and technical character he did not mean to imply that they were not doing manual work. Mr. Boulnois had called attention to the extraordinary extent to which waste materials—old tins and every conceivable thing—were made use of, and he thought they could hardly have listened to the paper without being struck by the ingenuity that was exercised in the improvising of these materials. It had been a case of making bricks without straw. One simply had to scout round and pick up anything that might be available. In addition to those difficulties, the difficulties attending the carrying on of sanitary work in the front-line trenches were almost inconceivable. One dare not show one's head or light a fire, and the marvel was that the work was carried out so well as it was. Concluding his

remarks Captain Martin said the sanitary sections at the Front had done most valuable work in educating the men of the combatant units in matters of sanitation, and it was to that as much as their executive work that much of the health of the troops was due.

NOTES FROM IRELAND.

SPECIALLY CONTRIBUTED BY AN IRISH CORRESPONDENT.

In the hope of making these notes as practically useful as possible the writer invites readers to favour him with communications thereon from time to time. These might be constructively critical, or helpfully supplementary, might indicate new points upon which information is desired, or might merely convey information. Communications will reach the writer if addressed "Irish Notes," 24 Bride Lane, Fleet Street, E.C.

Road Estimates and Expenditure.

Since the commencement of the war the cost of labour and materials has gone up considerably in Ireland, but many district councils, instead of providing for this increase, have reduced their estimates each year. This appears to be rather bad policy, as the amount allowed for the roads in the past was, as a rule, only barely sufficient for their maintenance, and, as a consequence, any reduction in this amount, under the present system of maintenance, will result in a deterioration of the roads from their normal condition. Of course, at the present time, owing to the scarcity of labour, no attempt is being made to carry out extensive works of road improvement in any part of the country, but by a slight increase in the annual estimates made by the district councils to meet the increased cost of labour and materials the roads might be prevented from going from bad to worse.

* * * *

One way in which deterioration might, however, be prevented, and economy effected, is by the introduction of direct labour in those counties in which it has not yet been tried. Over a great part of Ireland it is now found impossible to obtain contractors to tender for road maintenance work on anything like the old terms prevailing a few years ago, and many miles of roads are being placed each year in charge of the county surveyors. As a consequence, the maintenance of the roads by direct labour is gradually extending, but progress in this respect is very slow, and county surveyors in some counties find it impossible to persuade their councils to give the system even a trial.

* * *

A Future for Road-making Machinery.

The more extensive use of steam rollers and other machinery, and the opening up and developing of central quarries, would also result in ultimate economy. This is now generally recognised, and there is therefore every probability of a large demand for road machinery in Ireland on the conclusion of the war. Owing to the great difficulty in getting any new plant at present, and the lack of labour, the average complement of material cannot be put out on the roads. Some surveyors have been trying to hire plant recently, but they do not seem to have been very successful, and as it is probable that labour will be both dearer and scarcer after the war than it used to be, there is every indication that labour-saving appliances of one kind or another must be introduced.

* * * *

During the few years in which the Road Board extended its operations to Ireland, a good deal of road machinery was purchased, and many of the main roads were much improved. This improvement in the condition of the roads, without any appreciable increase in the rates, has not been lost on the councils concerned, and it may be assumed that, with the advent of peace and with the return of the country to its normal conditions, there will be a desire shown for further improvements in the condition of the roads and for more improved methods of construction. The chief demand will be for rollers, stone-breakers, motor tractors, horse sweepers, and probably small plant for the production of tar-macadam. In a few counties tar-macadam, Roemac, and other improved methods of road construction have been tried, and so far the results have, as a rule, been satisfactory.

Tarred-limestone Macadam.

The cost of laying down tarred-limestone macadam per ton in many parts of Ireland may be taken as follows:—

	s.	d.
Raising and breaking	1	10
Surface damage	0	2
Tar, 7 gallons at 3d.	1	9
Pitch, &c.	0	3
Mixing	1	0
Carting, say 2 miles	1	6
Spreading	0	9
Rolling	0	10
	8	1

While the untreated stone will cost—

	s.	d.
Raising and breaking	1	10
Surface damage	0	2
Carting, say 2 miles	1	4
Spreading	0	3
Rolling	1	0
	4	7

In both estimates the cost of scarifying or otherwise preparing the old road surface is omitted.

* * * *

Its Extended Use Advocated.

It may be suggested that the crude tar from small gasworks in Ireland is unsuitable for the manufacture of tar-macadam, but the writer's experience of such tar obtained in different small towns has satisfied him that excellent results can be obtained with such material, and he is therefore of opinion that every surveyor in charge of roads in Ireland should try an experimental length and see for himself what results he is able to obtain. It is evident from the above estimates that tarred-limestone macadam can be laid down at considerably less than twice the cost of laying down the untreated stone, while it will be found (1) that tarred-limestone macadam laid on a fairly dry bed has more than double the life of untreated stone; (2) that the cost of cleansing tar-macadam is far less (probably only one-sixth) than cleansing a surface laid down with untreated stone; (3) that traction is reduced, as well as the wear and tear of vehicles, while there is no limestone mud or dust to injure the clothes and property of the public using the roads on which this material is laid.

* * * *

On the other hand, it will be argued that tarred macadam does not afford sufficient foothold for horses using the roads, and that this objection is fatal in Ireland, where so many young horses are exercised on the public roads. It will be found, however, that if tarred macadam is not laid on gradients of more than 1 in 40, that no sealing coat is put on, and that the surface is kept clean, very few complaints will be made as regards insufficient foothold.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATION FOR LOAN.

Woolwich B.C.—£2,442 for electricity main extensions.

LOANS SANCTIONED.

Henley T.C.—£2,629 for main sewerage works.

Rawtenstall T.C.—£307 for electricity transformers.

LOANS REFUSED.

Nelson T.C.—£2,300 for a rotary washer scrubber at the gasworks.

Tilbury U.D.C.—£600 for the purchase of horses and carts for house and road scavenging purposes.

Leeds Corporation Roadmakers for France.—The Corporation of Leeds have supplied the military authorities with the names of nearly 400 men now in the various branches of the service who are skilled in roadmaking through their previous employment with either the corporation or private contractors. It may be that these men, or some of them, will be drafted from their present units into the new corps for the construction and maintenance of the roads in France. In addition to these 400, probably another fifty or so who are still in civil life will be available.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bradford T.C.—The Health Committee recommend the provision of a pathological laboratory, at an estimated cost of £400.

Dundee T.C. A committee has been instructed to report upon the provision of a pavilion at the Broughty Ferry lawn-tennis court.

Elland U.D.C.—The clerk has been instructed to inquire from the Local Government Board if the council would be permitted to spend an estimated sum of £708 for filtration plant at the public baths.

Exeter T.C.—With reference to the proposed small-pox hospital in the Ide Valley, it has been decided to prepare a revised estimate to meet the requirements of the Local Government Board as to the provision of an administrative building.

Hammersmith B.C. Property has been purchased for £650 for the purpose of an electricity sub-station for the Hythe road district.

Stafford T.C.—Various extensions are to be effected at the sanitary depot at an estimated cost of £750.

Tunbridge Wells T.C.—It is proposed to adapt certain premises as a public convenience for women.

York T.C. It is proposed to build the Carnegie library on a site in Old Mint-yard belonging to the city council.

HOUSING AND TOWN PLANNING.

Aldershot U.D.C. It is proposed to build thirty houses on each of two sites purchased by the council, and architects within a radius of 12 miles of Aldershot will be invited to submit designs.

Dublin T.C.—The city council are about to resume possession of an area of 30 acres of land at Glasnevin, now held by the Albert Model Farm, and intend to utilise it for the building of working-class dwellings. The site, which is almost on the boundary of the city, is considered to be eminently suitable for the purpose in view.

Okehampton R.D.C. A decision has been taken to purchase 5 acres of land at Chagford for the purpose of a housing scheme.

MOTOR TRANSPORT.

Blackburn T.C.—A motor wagon is to be purchased for the cleansing department.

Coventry T.C.—It has been agreed to purchase a motor wagon for £340 for use in connection with the prepayment gas meters collection.

Devon C.C.—It has been decided to make application to the Road Board for a loan of £2,250, free of interest, and repayable in five years, for the purchase of three tractors and trailers.

Keighley T.C.—The Health Committee are considering the purchase of an electrically driven vehicle for the removal of house refuse.

Lancaster T.C.—Sanction is being sought to a loan for the purchase of new motor 'buses.

Lewisham B.C.—Some discussion took place on the recommendation that a second-hand motor car be purchased for the use of the borough surveyor, Mr. E. van Putten. Replying to criticisms, the chairman of the committee, submitting the proposal, said the sum of £400 was provided in the estimates. He did not think any British firm would supply a new car such as they required for £400. The committee would only accept such a car as was reported by an expert as suitable. The recommendation was adopted, subject to the deletion of the word "second-hand."

Lincolnshire (Holland) C.C. — Mr. H. Moody, divisional surveyor, has advised the Main Roads Committee to consider the purchase of a light steam tractor and two tipping wagons.

Northwich R.D.C.—It has been agreed to purchase a steam wagon and trailer for £800.

Reading T.C.—The Tramways Committee recommend the purchase of three double-deck Tilling-Stevens petrol-electric omnibuses.

REFUSE COLLECTION AND DISPOSAL.

Bradford T.C.—The Cleansing and Team Labour Committee recommend the purchase of about 50 acres near Leaventhorpe Hall for tipping purposes. The purchase price is £100 per acre.

Crook U.D.C.—It was reported that the scavenging tender for one district, where 170 houses were affected, was £135, compared with £65 last year, and that in another case the amount had risen from £90 to £200. The surveyor, Mr. E. W. Ayton, was instructed to see the tenderers and report to the council.

ROADS AND MATERIALS.

Barking U.D.C.—The council have resolved that all available employees be granted permission to volunteer for road service in France, and also to offer the whole of the road repairing and maintenance plant upon the conditions set out in the letter of Brigadier-General Maybury.

Brandon R.D.C.—A letter was received from the Road Board with reference to the council's claim for £600, for which the board had offered £100 as settlement, stating that in view of the fact that military traffic still continued on some of the roads for which the claim was made, they considered it would be better for the council to confine their claim to extraordinary traffic. They asked for various statistics which the clerk was instructed to supply.

Burnham (Essex) U.D.C.—A tender has been accepted for steam rolling at 26s. 6d. per day, and scarifying at ½d. per yard.

Coalville U.D.C.—At the last meeting the surveyor, Mr. L. L. Baldwin, asked for leave of absence to enable him to offer his own services for road work in France, and the council agreed that this be granted, and his position kept open until his return; further, that in the event of his obtaining a commission, the difference between the Army pay and his salary be made up by the council.

Devon C.C.—The council have instructed the county surveyors to afford all possible help to the military authorities with respect to road service in France, and on the suggestion of Mr. Robinson, the county surveyor for the eastern division of the county, they have authorised him to offer his services, and will make the necessary arrangements for the re-division of the county if he is called up.—The council resolved on Tuesday to purchase an engine and stone crusher from Ilfracombe Urban District Council for £161 10s., a portable drilling machine for £174, and a portable granulator for £150.—The Bridges and Main Roads Committee in their report stated that they were of opinion that the use of tar on the roads was an economical form of maintenance, and, in order to enable the county surveyors to be in a position to commence the work as soon as the fine weather sets in next year, the council were recommended to sanction the expenditure of £4,500 for tar-spraying the main roads, subject to the Road Board defraying half the expenditure, as they have done in previous years. The council confirmed this recommendation.

Hetton U.D.C.—The surveyor, Mr. J. Harding, has been instructed to prepare plans and estimates for the improvement of a dangerous turn in the road at Snipper's-gate, near South Hetton. The scheme is being promoted jointly by this council and the Easington Rural District Council.

Hursley R.D.C.—The council have accepted the offer of the Road Board to make a grant of £250 towards the repair of roads damaged by excessive military traffic, on condition that the council spend £588 upon the roads within two years.

Salford T.C.—The shortage of men for street sweeping has been considered by the Highways Committee, but for the present there is no intention of engaging women's labour for this class of work.

Wimbledon T.C.—The town council have confirmed a recommendation by the Highways Committee that a poster be published asking the ratepayers for their

co-operation in removing snow from the streets by sweeping the footpath in front of their premises.

SEWERAGE AND SEWAGE DISPOSAL.

Doncaster T.C.—The Sewerage Committee have granted an increase of 3s. per week to the work-people employed on the Sandall sewage farm, and the women's wages have been increased from 16s. 6d. to 18s. per week.

Lewisham B.C.—Improvements are to be made in the surfaces-water drainage at Marsala-road, Ladywell, at an estimated cost of £240.

West Hartlepool T.C.—It has been agreed to execute sewerage reconstructions, at an estimated cost of £500.

WATER, GAS, AND ELECTRICITY.

Bath T.C.—Owing to the serious decrease in revenue caused by the lighting restrictions and other reasons, the city council have decided to increase the price of electricity by ½d. per unit, making the price 6d.

Bognor U.D.C.—The council have determined again to press upon the Board of Trade an objection they have raised to the policy of the Bognor Gas and Electric Light Company in making a charge of 13s. 4d. for electricity for any amount up to 20 units, and for every unit over at 8d. per unit. While admitting the legal authority of the company to make these charges, the council contend that the company were acting on a wrong basis in fixing the charges as they had done at a time when there was such need for economy.

Mexborough U.D.C.—Mr. A. J. Ram, K.C., has issued his award in the arbitration between the council and the Mexborough Water Company as to the price to be paid by the council for the undertaking of the company, under compulsory purchase powers. The price is fixed at £19,280, if the money is paid at the date specified in the council's Act (the end of the quarter following that in which the award is taken up), and the price is to be £22,060 if the money is not paid until a year after the conclusion of the war.

Paul U.D.C.—The council are inquiring of the Local Government Board if they would be willing to sanction a loan of £800 for a water supply for Newyln.

MISCELLANEOUS.

Alford U.D.C.—The council have adopted a resolution in favour of the decimal system of coinage and weights and measures.

Ashton-under-Lyne T.C.—The town council, in connection with the Waterloo and Bardsley Parish Councils, took the first definite step last week towards acquiring the tramways system of the Oldham, Ashton, and Hyde Electric Tramways, which have been running under private management for almost a quarter of a century.

Birmingham T.C.—The Parks Committee has made a profit of over £300 by growing potatoes in Perry Barr and the park nurseries at Quinton. All the work was done by the park keepers.

Blackpool T.C.—The corporation have settled the details of the Improvement Bill for which they are seeking powers in the 1917 session of Parliament. New promenade extension works to the south will cost about £86,000, and £30,000 is proposed to be spent in protecting the cliffs to the north of the borough.

Bournemouth T.C.—The borough engineer, Mr. F. P. Dolamore, has received instructions to proceed with the work of repairing the somewhat extensive damage done on the front by the recent storm.

Durham T.C.—The question of purchasing a new fire-escape is under consideration.

Hastings T.C.—The borough surveyor, Mr. P. H. Palmer, submitted a report with respect to a proposal to make use of the municipal parks for the growing of vegetables, and pointed out that the great problem to face was the shortage of labour. Eventually the town council passed a resolution that a special committee should be appointed to co-opt from outside to arrange for the cultivation of foodstuffs on such plots of land as might be suitable for the purpose.

Liverpool T.C.—The Finance Committee have referred to a sub-committee the question of converting into market gardens the lands which the various committees of the corporation had at their disposal.

Newcastle-on-Tyne T.C.—The Tramways Committee recommend the corporation to carry out certain tramway junctions at an estimated cost of £6,500.

Surbiton U.D.C.—It was on Monday agreed to increase the war bonus granted to the council's workmen from 3s. to 4s. per week, it being stipulated that the men should work fifty-one hours a week during the winter months. The nett amount of the increases granted will be £86 per annum.

Walmer U.D.C.—The council have decided to devote the public recreation ground at Walmer, of 1 acre in extent, to the growing of potatoes and other vegetables during the period of the war. The ground will be let free to applicants on condition that it is used to the best advantage for producing food.

Sewage Managers' Annual Meeting.—Pressure on our space compels us to hold over until next week our report of the annual meeting of the Association of Managers of Sewage Disposal Works held in London on the 7th inst.

Edinburgh Tramways.—It is understood, says the *Glasgow Herald*, that negotiations have been resumed for the acquisition by Edinburgh Town Council of the rolling stock of Edinburgh and District Tramway Company at the termination of the lease. Some months ago when it was sought to reach a settlement in the matter the tramway company demanded £75,000 for their 250 cars, while the town council offered £25,000. It was then understood that the council would be free, if so advised, to proceed with electrification, but it has, it is understood, been ascertained that no such undertaking would be sanctioned either during or immediately on the termination of the war. Accordingly the tramway company have now offered to sell for £50,000. The offer, it is understood, also includes an undertaking on the part of the company to be responsible for the upkeep of the railways for six years after the termination of the lease.

Cultivation of Commons.—The Commons and Footpaths Preservation Society has been in communication with the Board of Agriculture with reference to the proposed temporary appropriation of common lands for food production. It has received definite pledges from Lord Crawford that any land taken for cultivation shall be restored to the Commons after the war, as soon as the crops then in the ground have been harvested; that the land will be solely used for allotments, and that opportunity will be afforded to the society of expressing its views upon each scheme before any enclosure is effected. In consequence of these pledges and of the extreme and immediate necessity for increasing the supply of food, the society has intimated that it will not offer opposition to the proposals of the Government, while it is of opinion that common land should remain undisturbed if there is in its neighbourhood any unused or derelict land in full private ownership.

FOR OTHER ADVERTISEMENTS

See End of Paper.

ASSISTANT ENGINEER required for service in the Public Works Department, Straits Settlements, to prepare quantities, specifications and estimates for, and to supervise the erection of public buildings, roads, bridges, and other public works. Engagement for three years, with possible extension. Salary £360—£10—£480, with a duty allowance of £75 per annum. Free passages. Candidates between the ages of 25 and 35, unmarried, who have passed the A.M.I.C.E. examination, and also that held by the Institute of Municipal and County Engineers, and who have had at least three years' practical experience (exclusive of pupilage) as an Engineering Assistant, should apply at once by letter, giving full particulars, to Messrs. Gregory, Eyles & Waring, 12 Dean's-yard, Westminster, S.W., quoting M/8123. No person engaged on Government work or eligible for the Army need apply. (3,199)

REQUIRED Temporarily in County Surveyor's Office, Winchester, an Assistant for Surveys, Drawing and General Work in connection with maintenance of roads and bridges, preferably one having already experience in County or Municipal work.—Apply by letter, stating age, experience, &c., and salary required, to County Surveyor, The Castle, Winchester. (3,197)

CHISWICK URBAN DISTRICT COUNCIL. The Council are prepared to receive offers for several 350 to 400-gallon Water Vans, in working order. Apply to the Engineer, Town Hall, Chiswick. (3,198)

PERSONAL.

Mr. J. H. Harris, borough surveyor of Penryn, has volunteered for road service in France.

Mr. G. Plummer, surveyor to the Haywards Heath Urban District Council, has offered his services for road construction in France.

Mr. W. Davey, surveyor for the Hopton sub-district under the Brandon Rural District Council, has been released for road service in France.

Mr. W. B. Crouch, assistant surveyor to the Surbiton Urban District Council, who is on military service, has been gazetted a Sub-Lieutenant.

Mr. R. T. McKay, Geelong Waterworks and Sewerage Trust, Victoria, has been transferred from the class of associate-member to that of member of the Institution of Civil Engineers.

Mr. J. Bintley, who has been county surveyor of Westmorland for fifty years, and still continues to hold office, was recently presented by the members of the county council with a silver tea service and tray.

Mr. Norman S. Spencer, inspector of nuisances to the Ulverston Rural District Council, has been appointed sanitary surveyor and inspector of nuisances to the Wigton (Cumberland) Rural District Council.

Mr. John Barker, sanitary inspector to the Dumfries Town Council, has been granted leave of absence for six months on his appointment as labour manager under the Ministry of Munitions at one of their factories.

Mr. Hone has been appointed as clerk in the office of the East Molesey Urban District Council surveyor (Mr. J. Stevenson), and Miss Muriel Bagwell as clerk in the sanitary and public health department, at commencing salaries of 15s. per week each. Both are residents in the district.

Captain H. Garrett, borough surveyor of Torquay, of the Devon Royal Engineers, who for the past two years has held the position of chief engineer of the northern section of the Plymouth Garrison, has been appointed as roads and communication officer for the whole of the Southern Command.

The Road Board have expressed to the Wimbledon Town Council their appreciation of the services rendered by employees of the council, and have especially congratulated Mr. Whalley, the foreman, on the way in which he carried out his duties while they were working at Coventry for the War Office.

Mr. E. Martin, borough surveyor of Salford, has left to take up his duties as Major in the Roads Battalion which is being created for service in France. About 100 employees of the Salford Corporation have volunteered for this task, and about half of this number are men engaged in the cleansing department.

Mr. H. D. Woodcock, surveyor to the Guisborough Rural District Council, who has been serving as a private in the Army, has been offered a commission, and the council have agreed to ask the Local Government Board to permit them to make him a larger allowance than would be granted after his pay as an officer, 8s. 6d. per day, was deducted from his salary.

Mr. W. L. Harpur, county roads surveyor for Breconshire, eldest son of Mr. W. Harpur, city engineer, Cardiff, has received a commission as Captain in the Royal Engineers for road work in France, and is leaving shortly for that country. Mr. Harpur, who served his articles in the Cardiff Corporation offices, and was an assistant surveyor under the corporation, has been county roads surveyor for Breconshire for the past eight years, and was previously engaged on large public works in South Wales and London.

Mr. T. K. Roddan, sanitary inspector to the Dundee Town Council, has received permission to put down his name on the list of road surveyors volunteering for road service in France. In the course of the discussion on the matter at the town council Bailie Forwell said that some time ago another chief official went to the Army, and they had to get permission to have him recalled. He asked if it would not be better to send one of the assistants. In reply, it was stated that the chief sanitary inspector is an engineer had actual experience of road surveying.

Mr. F. W. McCullough, water engineer, Belfast, was at the winter general meeting of the Institution of Water Engineers, held in London on Friday last, re-elected president of that body, Mr. A. B. E. Blackburn (Sunderland) and Mr. C. H. Priestley (Cardiff) being at the same time re-elected as vice-presidents. Ordinary members of council were elected as follow: Messrs. F. J. Dixon (Ashton-under-Lyne), H. C. Head (Winchester), C. B. Newton (Hull), H. Preston (Grantham), C. H. Roberts (Aberdeen), E. J. Silcock (Leeds), H. W. Woodall (Bournemouth), F. Storr (Wrexham), F. W. Davies (Nottingham), and A. E. Cornwall-Walker (East Surrey Water Company).

Captain C. E. Maynard, M.C., of the 14th Northumberland Fusiliers (Pioneer Battalion), was married recently at Henley-on-Thames to Miss W. E. Slocombe. Captain Maynard is assistant to the surveyor of the Romford Rural District Council, and is now on leave in England after fifteen months' service in France. By a curious coincidence, another member of the surveyor's staff, Cadet F. Alderson, R.E., was married on the same day at Stratford, E., to Miss N. Hawkhead. Mr. Alderson recently returned from Salonika to take up a commission in the Royal Engineers, and is now in training at Chatham. Both gentlemen are recipients of handsome presents from the officers of the council. The remaining member of the staff, Gunner J. Page, is with the Royal Field Artillery in Egypt.

Mr. W. B. MacCabe, M.INST.C.E., chief engineer to the Calcutta Corporation, has retired. He has held office since 1903, and was associated with many schemes of public improvement in Calcutta, the chief of which, says *Indian Engineering*, was the Tallah tank project, by which the supply of water to the city was increased from 20,000,000 gallons a day to 36,000,000. Mr. MacCabe's name will also be associated with the solving of a long-standing drainage difficulty by the provision of the Tolly's Nullah syphon crossing. The roads claimed his constant attention, and the tar-macadam which has been used with such success was his invention. This is known as "Calcutta tar-macadam," and is specially adapted to the local climatic conditions. Mr. MacCabe has taken up his residence in Tasmania, where he has purchased an estate.

Mr. Edward Willis, the engineer to the Chiswick Urban District Council, has again been refused permission by his council to take up military or Government duties. Quite early in the war Mr. Willis applied for leave to accept a commission in the Royal Engineers. This being refused, permission was subsequently obtained from the War Office to form a company of Royal Engineers in Chiswick, for which he would have been responsible, the council temporarily undertaking the maintenance, until the company was complete. The council, however, again decided not to proceed with the scheme, and also at a later date refused Mr. Willis's application to apply for service in the Road Contingent for France. At the last meeting of the council a request was received from the Road Board for Mr. Willis to act as Officer on Roads and Communications in the Southern Command in place of Major Stallard, who was going to France, but, after some discussion, it was decided not to release Mr. Willis for such service, as it would take his whole time, and the remuneration was considerably less than his civil pay. We understand that he has, however, been engaged in inspecting and reporting upon military hospitals in connection with fire protection since the commencement of the war.

OBITUARY.

Mr. A. Clark, chairman of Messrs. Ham, Baker & Co., Limited, Municipal Engineering Works, Langley Green, Birmingham, died on the 7th inst., we regret to state, after a few days' illness. Mr. Clark, who was much respected in business circles, was forty-seven years of age.

Food from Recreation Grounds.—The list of municipal authorities that are arranging for the cultivation of the public parks and recreation grounds for the production of food includes the Folkestone Corporation, the Walmer Urban District Council, and the Woking Urban District Council.

Dampness in Sanatoria.—While it is desirable that persons suffering from consumption should live in the open air, it is equally necessary that they should be excluded from damp atmospheres. These facts were realised in the case of the Hawkmoor sanatorium, where precaution against dampness was taken by using Pudloed cement with quite satisfactory results.

The Rating of Waterworks.*

By CHARLES CLIFTON, PAST

The object of this paper is not so much to show how to construct a valuation, but rather to give some suggestions which may be useful to water engineers in assessing an assessment and judging whether or no the amount of the assessment is reasonable and acceptable. It will therefore be useless to repeat the statutory definition of the net annual or rateable value for assessment purposes, which is allotted in the Act of 1836 as "the rent at which the hereditament might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes, and tithe commutation rent charge (if any), and deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses (if any) necessary to maintain them in a state to command such rent."

The method approved by the High Courts for arriving at the assessable value of waterworks is to ascertain first the rateable value of the whole by reference to the receipts and expenses. The whole rateable subject is then divided into two portions—first, the indirectly productive portion, consisting of land (including the source of supply), reservoirs and trunk mains; and secondly, the portion which is directly productive of revenue—namely, the service pipes and mains. The annual value of the indirectly productive portion is then estimated by the usual methods employed for valuing land and structures, and deducted from the total rateable value. The balance is then allocated to the directly productive portion in proportion to the gross receipts in each parish.

The method of estimating an assessment by reference to the receipts and expenses may be briefly equated as follows:†

Receipts—expenses	= Profit divisible between the landlord and tenant.
The tenant's share	= The tenant's share of the profit for his capital, skill, trading risks, and responsibilities.
The landlord's share	= The gross estimated rental, or the gross profit remaining to the landlord after the tenant's claims have been satisfied.
The gross estimated rental—repairs and renewals, or the statutable deductions.	= The rateable value or the annual rental.

THE SPECIAL ACT.

An important preliminary is an inquiry into the Special Acts whereby the company obtains its powers. It may be found that the receipts are obtained from the maximum charges allowed by the Special Acts, and these restrictions may give rise to apparent anomalies respecting the value of the undertaking. As an illustration, a company spends a considerable sum of money in sinking deep wells and in erecting pumping plant, owing to the unsuitability of a supply hitherto obtained from surface water. In such a case the Assessment Committee look forward to an increase in the assessment, owing to these improvements. The property is certainly improved, but an examination of the facts shows that the rental value is diminished. At first sight this seems illogical, but the explanation is that the waterworks company are receiving their maximum receipts and cannot raise further revenue owing to the restrictions of their Act. The sinking of the wells and the erection of pumps not only adds to their capital expenditure, but results in a considerable increase in the expenses, owing to the cost of pumping, coal consumption and wages. There is also the extra provision necessary for repairs and renewals. The result shows that the rateable value of the entire undertaking has diminished.

RECEIPTS.

In testing the admissibility of the receipts obtained in previous years it must be remembered that the hypothetical tenant is looking into the future, and investigation may shew that the receipts of the last year require some modification. For example—the contract of a bulk consumer may have just expired and will not be renewed, or a large consumer may be leaving the district and erecting works elsewhere. Of course, the converse obtains, and it may be that a new customer has come into the district whose account for water may appreciably increase the receipts.

EXPENSES.

For the purpose of constructing the valuation, the cost of the landlord's repairs and renewals are, for obvious reasons, omitted from the working expenses, as these are included later in the statutable deductions. The cost of repairs shown in the accounts will probably include certain repairs and maintenance, the expenses of which would fall to the lot of a tenant. Such repairs and maintenance include the work connected with the fittings, service pipes, cleaning filters, and so forth. It is customary to allocate to the working expenses a fractional portion of the actual cost of the repairs to provide for such outlay.

Rates are omitted in the first instance as the amount to be eventually deducted is that represented by the rates upon the eventual assessment, and not upon the old assessment. As in the case of the receipts, the expenses should be examined before acceptance, in order to ascertain if they are normal, and if they are such as would be incurred during the tenancy.

THE TENANT'S SHARE OF THE PROFITS.

Considerable controversy may arise on this point, but most authorities agree that the only equitable way to estimate the tenant's share of the profits is by allowing a percentage on the gross receipts. The usual rule is 10 per cent.

It must be remembered that the problem to be solved is not the capital the tenant must invest in the undertaking, but the reasonable share of the profits which he would expect, and which it would be necessary to allow him in order to induce him to take over the tenancy. Some suggestions of the tenant's liabilities may assist in explaining why the tenant's share of the profits must be a considerable amount in order to induce him to rent the premises. The tenant's responsibilities do not begin and end with finding the necessary working capital, although this may not be a large amount in comparison with that required by such undertakings as gasworks and railways. In the case of waterworks the tenant has to take the responsibility of meeting claims arising from default in providing compensation water, and damages which might be claimed owing to impurities in the water, outbreaks of typhoid fever traceable to the public water supply being by no means unknown. He may find it necessary during his occupation to incur extra cost in filtering the water, owing to complaints of impurities, real or imaginary. He may have to face periods of considerable anxiety owing to drought, and at the same time his stock-in-trade may be heavily drawn upon by the extinguishing of large fires, and that without any compensation for the water used. He must not only possess considerable administrative ability, but must accept responsibilities which could hardly be compensated for by a small share of the profits out of all proportion to the rent he has to find the landlord.

STATUTABLE DEDUCTIONS.

As the allowance for repairs and other expenses necessary to maintain the heriditament in a state to command the rent is an average, it is customary to ascertain the expense incurred over a period of years and from this to find the average annual expense. It does not, however, follow that the average expense during any previous period will prove to be the average expense in the future. It will often be found that if a longer period be taken into account the average annual cost of repairs becomes less, due to the fact that the undertaking has been growing, and as regards the additions made in the immediate past, the cost of repairs does not appear in the accounts. In such cases some further allowance will have to be made for the probable average annual cost of repairs to such additional plant.

* From a paper read at the winter meeting of the Institution of Water Engineers on Friday last.

† For full details of such a valuation see "Transactions," vol. xvii., pages 79 and 80.

In addition to the actual expenditure on repairs and maintenance there is the question of the eventual renewal of the destructible portion of the undertaking, which cannot be provided for by ordinary repairs. This is usually provided for by creating a sinking fund which will provide the necessary cost of renewal at the end of the estimated period of life.

APPORTIONMENT.

The question of apportionment gives rise to much contention. Many undertakings extend through several rating areas governed by authorities who employ different valuers who may hold different opinions. It is here one sees the evils of blindly adhering to the principle that an estimate of the annual value for assessment can be arrived at by taking a percentage upon the structural costs. The application of this principle may result in the undertaking being assessed at a considerably larger sum than the rateable value of the whole as ascertained by consideration of the receipts and expenses. This was foreseen in the Mile End case, 1847, where the Court in giving their decision, said

"The rule of law laid down by the Act of Parliament for ascertaining the rateable value of any subject refers to an estimate of the rent it should yield. The outlay of capital might furnish no such criterion, since it might have been injudiciously expended, and what was costly may have become worthless by subsequent changes."

And, again, in the West Middlesex case, 1859, the Court, after suggesting that the annual value of the dead works might be estimated on the assumption that the hypothetical tenant of the live works would pay adequate remuneration to the contractor of the dead works for the land and fixed capital vested therein, made this proviso: "This Court is bound to protect the occupier of such an apparatus from being rated beyond the rateable value of the whole taken together."

In ascertaining the annual value to be apportioned to the dead works it does not follow that the capital outlay furnishes the true criterion of value on which one should base his calculations. Enquiry should be made as to the effective capital value to the tenant for his present needs and purposes. A waterworks undertaking has to look ahead many years, and works are designed to meet not only present requirements, but those of the future.

The question of distinguishing between the effective capital value and the capital cost was raised in the case of *Liverpool* v. *Llandudno Union*, 1898. In this case the Court were of opinion that it was correct to make an allowance for excessive expenditure upon a reservoir having a capacity beyond existing requirements, either by writing down the capital outlay or by reducing the rate of interest to a lower figure.

The question of excessive cost of construction was raised in the case of the *Mayor, &c., of Bradford* v. *Keighley Union*, in 1906, when the High Court upheld the principle of making due allowance for such excess expenditure.

WATER UNDERTAKINGS OWNED BY PUBLIC AUTHORITIES.

The growth of water undertakings owned by public authorities has led to considerable confusion as to how such undertakings should be rated. The difficulty seems to have arisen from the lack of any reasonable alternative being offered to the High Courts. On the one side the claim was made to rate works as unfettered tenancies and without any restrictions, and on the other side, to rate them in accordance with the receipts permissible by the restrictions imposed by the Act of Parliament. Cases decided in 1875 and 1876 held that the hypothetical tenant would only give such a rent as the restrictions imposed by Statute would enable him to pay. The result was consummated in 1883, when the rateable value of an undertaking was declared to be *nil*, because the local authority were precluded from making a profit.

In a case decided in 1892 the question of qualification of the restrictions appears to have arisen to some extent, as the Court held that the restrictions imposed were tantamount to an arrangement between the promoters and the consumers, and therefore, in the absence of an alternative, the assessment was to be calculated as the rent of an unfettered tenancy. In spite of this, the Court dissented from the idea that the tenant might charge any rate he pleased.

Where Parliament grants a monopoly in land it follows that some restrictions will certainly be laid upon the promoters. The term "unfettered" must always be qualified to this extent.

Summing up, the reasonable course to adopt is to take as admissible restrictions such as would not prevent the undertaking being carried on as a commercial concern; or, in other words, the restrictions which an ordinary trading concern would accept. The restrictions, however, which are often laid on local authorities are partly voluntary. It must be remembered that the local authority represents the consumers, who are in effect the occupiers and the owners, and therefore the revenue obtained from the water charges is open to challenge. One body of ratepayers may prefer to pay a profitable charge for water and apply the profits to the relief of the rates, while another body may prefer to pay an unprofitable rate for water and to pay any losses by an extra charge upon the rates.

The difficulty of ascertaining the rating receipts has given rise to the doctrine that waterworks belonging to public authorities can only be assessed by taking a percentage upon the capital value. This principle has been approved in the case of board schools, lunatic asylums, and sewage works. In all such cases the responsibility is upon the local authority to provide such works, and although they are non-profitable undertakings, the principle was upheld that there was beneficial occupation, as it enabled the local authorities to discharge their public duties, and that, for the purpose of doing this, they would either be willing to rent such undertakings from a contractor, or, as is usually the case, to borrow the necessary money at certain rates of interest. No new rule of rating waterworks is instituted by these findings.

The rule still holds that "no higher rent must be fixed as the basis of assessment than that which it is believed the tenant would really be willing to pay for the occupation of the premises" (Lord Herschell in *London County Council* v. *Erith*, 1893). In this case the Court approved the principle of assessing property in the hands of a public body by taking a percentage upon the capital value.

It would be incorrect to suggest that capital costs may not be a guide to the annual value in some cases, or that, providing the percentage applied and the estimate of the capital value are reasonable, the result must necessarily be unfavourable to the public authority in occupation of the works. The result may be quite favourable, but, nevertheless, in considering this point it must be borne in mind that the custom of arriving at the assessable value by taking a percentage upon capital cost is apt to lead to fallacious results. The evolution of the value of undertakings may owe its birth to the original cost, and which we will assume fixed the first rent, but this rent will invariably be subject to changes, and will from time to time reveal the true market value, in spite of what the actual cost may have been. It is the rent that governs capital value, apart from the value of any reversionary interests or future expectations. These latter considerations do not, however, concern the capital value for rating purposes. The capital value thus revealed by the rental value may be far removed from the original capital outlay.

For this reason calculations based on costs may lead to a false quantity, and before accepting the assessment of a public authority's waterworks which has been arrived at by taking a percentage upon the capital outlay, or an estimate of the capital value, as the case may be, all possible enquiry should be made to ascertain if the percentage applied and the estimate of the capital outlay is justified.

It may be that it can be shown the receipts are based on the reasonable market value of the water, and that the water rents are such as would be charged if the undertaking were in the hands of a company trading for profit. A valuation on such receipts may reveal that the percentage taken is too high, or that the capital outlay has been so heavy that it is difficult to make a sufficient profit to pay a reasonable rate of interest upon the capital. A comparison of the charges made by other undertakings may prove useful evidence as to the market value of the water.

LAND COVERED WITH WATER.

Section 211 (*b*) of the Public Health Act, 1875, provides that "the occupier of any land covered with water or used only as a canal or towing-path for the same, or as a railway constructed under the provisions of any Act of Parliament for public conveyance, shall be assessed in respect of the same in the

proportion of one-fourth only of such nett annual value thereof."

The question of what is meant by "land covered with water" was discussed in 1861 when in the case of *Regina* v. *Bermondsey Waterworks*, it was held that a reservoir should be included in the category of "land covered with water," but not in the pipes and mains. In the following year it was decided in the case of *Regina* v. *Newport Dock Company* that land occupied by wet docks was "land covered with water" and entitled to the statutory relief. Another case which was also tried under an Act previous to 1870, and one which for our present purpose is more important, is the case of the *East London Waterworks* v. *Poplar Sewers Indictment*, 1870. In this case it was held that the canal and filter-beds occupied by the company were "land covered with water," and therefore entitled to be rated at one-quarter of the assessment, and that the remainder of the property was assessable at its full value. This apparently included land occupied by pipes and mains.

Another case of interest is that of the *Hampton Urban District Council* v. *Lambhall Water Company*, 1900, which dealt with the reservoirs and filter-beds at Hampton. Some dispute arose as to the inclusion of the artificial embankments which were constructed for the purpose of making these works. The effect of the decision was that the whole structure necessary for containing the water should be taken as "land covered with water."

The most recent case on this question was before the Courts this year. In this a claim was made to include "dry docks" as "land covered with water." The Court of Appeal held it was not land covered with water, but included the dock entrances. It was also held that under ordinary and normal conditions these docks are pumped dry; that "Smith's dock case" was one in which water was usually over the land, and not one in which the presence of water is only occasionally essential to the beneficial occupation of the land for the purpose for which it is occupied, the question was one of degree.

These decisions certainly show that the words "land covered with water" need not be taken literally, and that it is incorrect to infer that the exemption only refers to that portion of the soil which is actually covered. The Hampton case disposes of such a suggestion. It may be inferred from the East London case that an intermittent covering of water does not nullify the benefit, because in this case there were two reservoirs used intermittently.

These judgments appear to show conclusively that where the presence of water over land whether intermittent or constant, is essential to the beneficial occupation of the land, the appurtenant structures which are necessary for the enjoyment of such user of the land should be included in the category of "land covered with water." The effect upon water undertakings is that we have reservoirs and filters and the appurtenant structures necessary to enable them to hold water included in the category, but that mains and pipes are excluded.

Revenue from Watersheds.—Replying at the last meeting to certain criticisms directed against the management of the Torquay Town Council's watershed, Alderman Glanfield, on behalf of the Waterworks Committee, said their first duty was to do everything for the protection of the purity of the water, which was supplied to upwards of 60,000 persons. The council decided to remove certain buildings on the watershed because at one time it was proved by analysis that matter was finding its way into the water which it was necessary should be stopped. For some years the corporation farmed a portion of the watershed, and they knew with what result. They had land of some 2,000 acres, and 394 acres of that was outside the purity zone, let at a rental of £167, with ten small holdings of 112 acres let at a rental of £90. There were sundry sums from the sale of rabbits, and the sale of grass and ferns, and the total income in respect of that was £250. It was true that the committee had received offers for more land, and they would be prepared to consider any reasonable offer, provided that the purity of the water was maintained. He admitted that the growing of potatoes was very important at the present time, but he pointed out that it would be impossible to get labour to do it. They were prepared to do all they could to promote the growth of potatoes on the watershed, and to increase the revenue if it was possible to do so, but there it must end, because they could do nothing in the way of farming on the watershed.

SOME RECENT PUBLICATIONS.*

THE AMERICAN CIVIL ENGINEERS' POCKET BOOK. Edited by Mansfield Merriman and others. Price 21s. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

Containing as it does 1,571 pages, divided into sixteen sections, this "pocket book" is in itself a reference book on practically every subject that can fairly be described under the comprehensive title of civil engineering. Many of the sections are of special interest to municipal engineers, as, for instance, those on Surveying, &c., Materials of Construction, Plain and Reinforced Concrete, Hydraulics, Pumping and Water Power, Water Supply, Sewerage and Irrigation, and Highway Engineering, to mention but a few of the most striking examples. The popularity of the book may be gathered from the fact that this is the third edition that has been called for in six years. The principal new feature is an entirely new section on Harbour and River Works. The several sections are divided up into articles, an arrangement which renders reference easy. The index, which is not the least important part of a volume of this kind, is very full, and appears to have been carefully prepared.

MANURING FOR HIGHER CROP PRODUCTION. By E. J. Russell, D.SC. Price 3s. nett. Cambridge University Press.

This book makes an opportune appearance at a time when there is a special duty upon all farmers to increase the produce of their land to the utmost. It contains carefully arranged information about manures and soil management which cannot but prove helpful to farmers in drawing up their schemes for cropping. The author gives facts from which any farmer can draw conclusions suited to his own conditions and bearing on his own problems. As regards sewage sludge it is stated that when it "can be bought cheaply it may be of some use, especially in wet districts, but no general opinion can be given, and it ought not to be used without first consulting the county adviser. . . . In some cases, however, the sludge contains so much lime that it proves beneficial, but care should be taken not to pay too much for it." This opinion of an expert is of no little interest to municipal engineers.

THE STABILITY OF ARCHES. By Ernest H. Sprague, ASSOC.M.INST.C.E. Price 4s. nett. London: Scott, Greenwood & Son.

This book forms the twentieth volume of the publishers' "Broadway" Series of Engineering Handbooks, and in it the author investigates the principles upon which the stability of an arch is determined. He points out that most methods of solving the problems involved depend ultimately on the elastic theory, to which he therefore devotes particular attention. The first chapter is of a preliminary character, and is followed by chapters dealing with the Three-pinned Arch, the Elastic Theory, the Two-hinged Arch, the Hingeless Arch, Masonry and Concrete Arches and their Design, and Loads and Stresses. The author's experience as teacher and lecturer enables him to deal with such subjects in a singularly clear manner, and he has produced a little book which will be invaluable to the engineering student especially and also to the practitioner.

THE ORDERS OF ARCHITECTURE. By A. B. Greenberg. Price 2s. 6d. nett. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.

This book consists of a series of twenty plates, bound on the loose-leaf principle, illustrating the orders of architecture. The plates, which are very clearly reproduced, are intended as a drawing manual to supplement the work on "Architectural Drafting," written by the author in collaboration with Mr. Howe. They should be of great interest and value to the student of architecture.

CONSTRUCTION, EQUIPMENT AND MANAGEMENT OF A GENERAL HOSPITAL. By D. J. Mackintosh, M.A.O., M.B., LL.D., F.R.S.E. Price 15s. nett. Edinburgh and London: W. Hodge & Co.

Dr. Mackintosh has such a well-established reputation in connection with all matters concerning hospitals that no words of ours are needed in commendation of a volume on such a subject from his pen. This is the second edition of a work, the first

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price, plus postage in the case of nett books.

edition of which has enjoyed considerable popularity. It is useful alike to superintendent and architect. The various units are dealt with in separate chapters, each of which is profusely illustrated, while at the end will be found a series of seventeen most valuable plans. The chapter on the "Construction of Hospitals of a Semi-permanent Nature" is contributed by Mr. John Wilson, F.R.I.B.A. The book will prove of great value to all who are practically interested in the planning and construction of hospital buildings.

MUNITION WORKS AND BUILDING BY-LAWS.

AN INTERESTING CASE.

A company owning a shell factory were summoned by a district council at petty sessions on Monday for not depositing plans of new buildings in accordance with the by-laws.

Mr. C. Carr, representing the defendant company, urged that the company were exempted from submitting plans as they came within the clause in the by-laws regarding buildings intended, or likely to be intended, for His Majesty's use or service. The factory was controlled entirely by the Ministry of Munitions, who had provided money for its construction. Nearly 5,000 workers were employed, and the factory was working day and night on war material.

The manager of the company said no plans were submitted, as it was not considered necessary to do so at a time when the country was at war.

The Bench decided that an offence had been committed, and imposed a fine of 21s.

Notice of appeal was given, and the Bench were asked to state a case.

THE NEWTON SANITARY SYSTEM.

INCIDENT AT A TRIBUNAL.

The sanitary system of Newton (Montgomeryshire) came in incidentally for criticism in the course of the hearing of a case at the Liverpool County Tribunal on Monday.

The military representative (Mr. G. F. Clarke) appealed against the conditional exemption of William Cawley, employed as a nightsoilman and carter by the Newton Urban District Council. On behalf of Cawley it was urged that his work was very important from the point of public health. The council claimed that he was indispensable.

Mr. Clarke (the *Liverpool Post* reports) said the only reason why Cawley's services could be said to be indispensable was because of the Newton Council's antiquated sanitary methods. With the adoption of modern methods only a third of the council's staff would be needed. At present they had thirteen men connected with what only by a stretch of words could be called a sanitary department.

The chairman (Alderman Mather): Do you live at Newton, Mr. Clarke? I do.

The chairman of the Newton Council (Dr. Latham) warmly protested against Mr. Clarke's attack on the council's methods.

"I want to say that Mr. Clarke himself is responsible for much of the antiquated condition we are in. When we tried to remedy this state of things he went round among the council appealing to them not to put him to this expense. When he was in the council Mr. Clarke was the most obstructive member we had in the matter of sanitary reform."

Mr. Clarke: I deny that. It wasn't time, and Dr. Latham knows it. It was I who voluntarily introduced the water-carriage system into Newton.

The chairman: You should have settled all this between you two gentlemen before coming into court.

The exemption was refused, the chairman remarking that the council would have to get a man over military age to do the work.

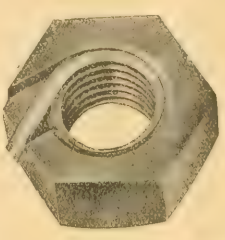
County Councils Association.—In consequence of the present offices of the County Councils Association having been suddenly commandeered by the War Office, it has been necessary to acquire temporary premises. The new address of the association is Grosvenor Mansions, 82 Victoria-street, Westminster, S.W. The telephone and telegraphic address will remain the same.

PERFLOC NUTS.

There is probably not an engineer in the world who has not at one time or another been faced with the problem of nuts coming loose through vibration, and to overcome this difficulty a large number of locking devices have from time to time appeared on the market. It is claimed that it has been left for the Perfloc nut to solve the problem.

The Perfloc nut is simply an ordinary nut with a special spring coiled in the thread, anchored at the top and loose at the bottom. The action of screwing the nut on the bolt opens the spring, allowing the nut to be screwed on easily; but any attempt to unscrew the nut has the effect of closing the spring, thus binding on every thread of the bolt, locking the nut securely and instantaneously.

When it is desired to remove the nut the short projecting arm of the spring is held back by an ordinary spanner (thus preventing the locking action from taking place) and the nut easily removed, and it may be used again any number of times without damage to itself or the bolt.



The outstanding feature of the nut is that the greater the vibration the tighter it becomes, and that the invention is not merely a theoretical one is proved by the fact that Perfloc nuts have been in use at Rickmansworth pumping station since 1911, and have given perfect satisfaction. After years of constant use in situations where vibration has been at its highest point, these nuts have stood every possible test from a practical point of view. Moreover, they have been proved to be at least as strong as ordinary nuts and no more liable to rust. A further claim and an examination of the nut certainly goes to confirm this—is that so good a fit is obtained by the Perfloc system as to make it impossible for rust or grit to damage the spring or the thread of the bolt covered by the nut.

Timber, Plywood and Woodwork.—We would direct the attention of our readers to the full-page advertisement of Messrs. C. Jennings & Company, of Pennywell-road, Bristol, which appeared in our issue of last week. The information given in the advertisement should be of the greatest value to all users of timber, plywood or woodwork. We understand that the firm are prepared to answer any questions relating to the materials of which particulars were supplied, or furnish prices delivered to any part of the world, either of goods mentioned in the announcement or of others not included in it. They inform us that they hold stock at their branches and warehouses at Porthcawl (South Wales), Leyland and Pembroke Dock, Leicester, Swansea, Hull, Liverpool, Manchester, Newcastle and other places, and will be pleased to receive inquiries.

CONCRETE INSTITUTE.

PROGRAMME OF SESSION 1916-17.

Meetings of the Concrete Institute for the 1916-17 session have been arranged as under:—

December 21st.—Prof. Henry Adams, M.INST.C.E., on "Pile Driving and the Supporting Power of Piles."

January 25th.—Mr. C. R. Peers, chief inspector of ancient monuments, H.M. Office of Works, on "The Care of Ancient Monuments."

February 22nd.—Mr. Robert N. Sinclair on "Southampton Docks, Re-modelling of an Old Dry Dock."

March 22nd.—Mr. W. Cleaver on "The Rational Design of Reinforced Concrete Wharves and Jetties, with particular reference to those for Wet Docks, having a Permanent Water Level."

April 26th.—Mr. S. Bylander on "Secondary Stresses in Structural Steel."

The meetings will be held at Denison House, 296 Vauxhall Bridge-road, Westminster.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTH-WESTERN DISTRICT MEETING.

A meeting of the members of the South-Western District will be held at the Guildhall, Exeter, to-morrow (Saturday), at 3 p.m., to consider the following resolution submitted by the Orphan Fund Committee of the institution:—

That one or more Orphan Fund stewards be appointed in each district to advocate the claims of the fund, to promulgate its work, to solicit and collect subscriptions and donations, to investigate cases needing assistance, and to report to the secretary on all questions relating to the work of the fund."

It is hoped that every member will endeavour to be present.

D. EDWARDS, ASSOC.M.INST.C.E.,
Hon. District Secretary.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—MR. HENRY C. ADAMS, M.INST.C.E., M.I.MECH.E., F.R.SAN.I.

President-Elect—MR. EDWARD WHITWELL, F.I.S.E., M.S.A., Engineer and Surveyor, Abersychan Urban District Council, Llow, R.S.O.

ANNUAL MEETING.

The eighty-second general meeting will be held in London on Saturday, January 6th.

PROGRAMME.

11.30 a.m.—Council meeting.

11.45 a.m.—Meet in the council chamber, No. 1 Southampton-row, W.C.

12 o'clock.—Annual general meeting.
Minutes of last annual general meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of president and council for the year 1916-17.
Installation of president.
Any other business.

12.45 p.m.—Adjourn for lunch.

2.30 p.m.—Reassemble in council chamber.
Presidential address.
Discussion on the following papers to be presented at the meeting:
"A Resume of Public Health Matters," by G. Belson Chilvers, M.R.SAN.I. (Member).
"Practical Road Work," by Geo. Rodley (Member).
"Notes on the Use of Electricity in Municipal Engineering," by Horace Boot, M.I.E.E., M.I.MECH.E. (past-president).

B. WYAND,
Secretary.

39 Victoria-street, S.W.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

GASWORKS SUPERINTENDENT.—December 16th.—Shipley Urban District Council. £140 per annum.—Mr. I. Lindow, clerk, Somerset House, Shipley.

SANITARY INSPECTOR.—December 18th.—Runcorn Rural District Council. £120 per annum.—Mr. W. E. Hough, acting clerk, 31 High-street, Runcorn.

SURVEYOR AND INSPECTOR.—December 19th.—Sandgate Urban District Council. £100 per annum.—Mr. J. Shera Atkinson, clerk, Council Offices, Sandgate, Kent.

SURVEYOR AND INSPECTOR.—January 15th.—Dorking Urban District Council. £250 per annum.—Mr. W. J. Hodges, clerk, 64 South-street, Dorking.

ASSISTANT ENGINEERS.—March 31st.—Indian Public Works and State Railways Department. Not less than twenty-one and not more than twenty-four years of age on July 1st.—The Secretary, Public Works Department, India Office, London, S.W.

ROLLER DRIVER.—Kiveton Park Rural District Council.—Mr. F. Hewitt, engineer and surveyor, Council Offices, Kiveton Park, near Sheffield.

ROLLER DRIVER.—Ambleside Urban District Council.—The Surveyor, Council Offices, Ambleside.

TEMPORARY ASSISTANT SURVEYOR.—Blackwell Rural District Council.—Mr. H. Silcock, surveyor, 67 Westgate, Mansfield.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

LEON (Spain).—August 15, 1917.—Schemes are invited for a water supply, and also for the improvement of the sewerage system. A prize of £1,000 will be awarded to the author of the selected scheme.—Secretaria del Ayuntamiento, Leon, Spain.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

ISLE OF WIGHT.—December 18th.—For alteration to a school, for the county council.—Mr. J. Duiton, clerk, County Council Offices, Newport, I.W.

WEYMOUTH.—December 18th.—For the erection of kitchen accommodation at the isolation hospital, for the corporation.—Borough Surveyor, Town Hall.

SUNDERLAND.—December 21st.—For repairs and additions to a school, for the town council.—Mr. J. W. Moncur, borough engineer, Town Hall.

Engineering: Iron and Steel.

LONDON.—December 19th.—For the supply of 325 tons of rolled steel bar for magnetic brake shoes, for the county council.—Chief Officer, L.C.C. Tramways, 62 Finsbury-pavement, E.C.

SIDMOUTH.—December 20th.—For the construction of a sea wall and other contingent works, for the urban district council.—Mr. S. Hutton, engineer, Public Hall, Exmouth.

BURNLEY.—December 20th.—For the supply of 1,144 yds. of 3-in. turned and bored cast-iron pipes, for the rural district council.—Mr. H. Pritchard, engineer, 18 Nicholas-street, Burnley.

DURBAN.—January 3rd.—For the supply of a 3,000-kw. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation.—Electricity Department, Dock-road, Cape Town.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Iverell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

AUCKLAND (New Zealand).—January 21st.—For the supply of mild-steel or iron gates and fencing, for the Harbour Board.—Messrs. W. & A. McArthur, Canberra House, 18-19 Silk-street, Cripplegate, London, E.C.

Mechanically-Propelled Vehicles.

MADRID.—December 17th.—For the supply of four motor street-watering vehicles, at a cost not exceeding about £1,220, and two motor road-sweepers, at a cost not exceeding £870.—Department of Commercial Intelligence, 73 Basinghall-street, London, E.C.

MANCHESTER.—December 18th.—For the supply of a new 3-ton steam lorry, rubber-tyred, 10 to 12 m.p.h., for the corporation.—The Chairman, Rivers Committee, Town Hall.

Roads.

DORKING.—December 16th.—For the supply of 14,000 gallons of refined tar, for the urban district council.—Mr. W. A. Clegg, surveyor.

PERRY BAR.—December 19th.—For the supply of Rowley ragstone, blast-furnace cinder or slag, and horse provender, for the urban district council.—Mr. E. Bailey, surveyor, Council House, Green-lane, Hamstead, Birmingham.

WEYMOUTH.—December 21st.—For the supply of between 400 and 500 tons of 2-in. broken granite, for the corporation.—The Town Clerk.

KESTEVEN.—December 23rd.—For surface dressing with Tarvia on the main roads, and for the supply of ¼-in., ¾-in., and 1½-in. tarred slag, limestone, or granite, for the county council.—Mr. W. B. Purser, county surveyor, Grantham.

DERBYSHIRE.—December 23rd.—For the supply of broken stone and tar-macadam, such as granite, basalt, slag, limestone, tarred macadam, and distilled tar, for the county council.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

KENT.—December 23rd.—For the supply of 35,000 tons (more or less) of broken roadstone, such as Guernsey, Jersey, or Alderney granites, Clee Hill basalt, Leicestershire granites, Penlee, St. Keverne, or other Cornish granites, Northumberland whinstone, Penmaenmawr or other Welsh granites, or other equally durable material; also 35,000 tons (more or less) of tarred macadam, 10,000 yds. (more or less) of surface-picked or grubbed flints, and 5,000 yds. (more or less) of Kent rag, for the county council.—Mr. W. B. Prosser, clerk, Sessions House, Maidstone.

SOMERSET.—December 27th.—For surface tarring on main roads, for the county council. Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

BEXLEY.—December 27th.—For the supply of tar, highway materials, best glazed stoneware socketed pipes, and best Portland cement, for the urban district council.—Mr. W. T. Howse, surveyor.

CONWAY.—December 31st.—The rural district council are advertising for a second-hand stone crusher, to break from 27 to 30 tons per day.—Mr. H. T. Davies, surveyor, Rose Hill-street, Conway.

ROMFORD. January 1st.—For the supply of broken granite, for the rural district council. The Highway Surveyor.

DURHAM. January 15th.—For tar-spraying on the main roads, for the county council.—Mr. Albert E. Brookes, county surveyor, Shire Hall, Durham.

WORCESTERSHIRE.—January 20th.—For the supply of granite, blast-furnace slag, and tar-macadam, for the county council.—Mr. C. F. Gettings, county surveyor, 30 Foregate-street, Worcester.

Sanitary.

SOUTHOWRAM.—December 16th.—For scavenging the whole district, for the urban district council. Mr. E. Morley, sanitary inspector, 11 Pinnar-lane, Southowram.

MUTFORD.—December 16th.—For the removal of house refuse and nightsoil, for the rural district council.—Mr. W. B. Forward, clerk, 148 London-road, North Lowestoft.

CHORLEY.—December 18th.—For the supply of disinfecting liquid, for the corporation.—Sanitary Inspector, Back-street, Chorley.

PLYMOUTH.—December 18th.—For the collection of house refuse, street cleaning and watering, sanding streets, and providing horses and horse-brooms, for the corporation.—Mr. J. Paton, borough surveyor and engineer, Municipal Offices, Plymouth.

COOKHAM.—December 19th.—For the removal of house refuse, for the rural district council.—Mr. T. W. Stuchbery, clerk, 1 Park-street, Maidenhead.

CAMBERWELL.—December 19th.—For the removal of street refuse, and trade refuse and excavation by barge, for the borough council.—Mr. W. Oxtoby, borough engineer, Town Hall, Peckham-road, S.E.

CHORLEY.—December 20th.—For the supply of galvanised ashbins, for the corporation.—Sanitary Inspector, Back-street, Chorley.

WANDLE VALLEY.—December 21st.—For the supply of coal and coke, hire of horse and carts, cartage of sludge, lime and cement, for the Wandle Valley Joint Sewerage Board.—Mr. R. M. Chart, acting clerk and surveyor, Vestry Hall, Mitcham.

Stores.

ABERDEEN.—December 18th.—For the supply of articles for the gas department.—The Gas Engineer, Cotton-street, Aberdeen.

Miscellaneous.

GLASGOW.—December 18th.—For the supply of fire-bricks and fireclay retorts at the gasworks, for the corporation.—Mr. A. Wilson, engineer, 45 John-street, Glasgow.

OXFORD.—December 27th.—For the supply of ironmongery, castings and wrought-iron work, oils, paints, and disinfectants, for the corporation.—City Engineer, Town Hall.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

DECEMBER.

15.—Illuminating Engineering Society: Mr. L. Gaster on "War Economies in Lighting." Royal Society of Arts, John-street, Adelphi, W.C. 5 p.m.

16.—Institution of Municipal and County Engineers: South-Western District Meeting at Exeter Guildhall. 3 p.m.

19.—Institution of Civil Engineers: Further discussion on Mr. P. M. Crosthwaite's paper: "Experiments on Earth Pressures." 5.30 p.m.

21.—Concrete Institute: Prof. Henry Adams on "Pile Driving and the Supporting Power of Piles." 5.30 p.m.

JANUARY.

6. Institution of Municipal Engineers: Annual Meeting, 4 Southampton-row, London, W.C.

APPOINTMENTS OPEN.

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DORKING URBAN DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR AND INSPECTOR OF NUISANCES.

The above Council require the services of a competent Surveyor and Inspector of Nuisances, at salaries of £130 per annum as Surveyor and £120 per annum as Inspector of Nuisances.

Candidates must be experienced in surveying, preparation of plans and estimates, road making, drainage, sewage treatment and sanitary matters, and will also be required to take charge of public baths, refuse destructor works, and be able to satisfy the requirements of the Local Government Board as an Inspector of Nuisances (the appointment of Inspector being subject to the approval of such Board). The Inspector's duties will include those under the Public Health Acts, the Orders of the Local Government Board, the By-laws of the Council, the Dairies, Cowsheds and Milkshops Orders, and the Factory and Workshops Act, 1891, &c.

The successful candidate will be required to devote his whole time to the service of the Council, to give satisfactory security in the sum of £100, and to reside within the district.

Canvassing, either directly or indirectly, will disqualify.

Selected candidates will have notice to attend on the day of election, and will be allowed third-class railway fare.

Applications, endorsed "Surveyor and Inspector," stating age, experience, and qualifications, with copies of not more than three recent testimonials, must be sent to me, the undersigned, not later than the 15th January, 1917.

WM. J. HODGES,
Clerk to the Council.

64 South-street,
Dorking.
December 13, 1916. (3,195)

TENDERS WANTED.

WANTED, by the Conway Rural District Council, a Stone-Crusher (second-hand), in good condition, to break from 27-30 tons per day; complete with screen and travelling wheels. Price and full particulars to be sent to me on or before the 31st inst.

H. T. DAVIES,
Surveyor to the Council.

Rose Hill-street,
Conway. (3,193)

The Surveyor

And Municipal and County Engineer.

Vol. L. DECEMBER 22, 1916. No. 1,301.

Minutes of Proceedings.

Nitrates from Sewage.

When those who do the thinking of the world first bring forward the results of their work they are invariably met by the man of sound common sense, or so called, whose view of life is always retrospective, and who is therefore quite unable to look ahead. All history shows us that we have stoned the prophets, and that genius generally remains unrecognised. It is true that we are not all gifted with the peculiar qualities which enable us to look into the future and to imagine new things which will some day prove to be beneficial to the human race, but we may at any rate attempt to get rid of that horrible condition of complacency which damps the ardour of the enthusiast and refuses to see the possibilities of new ideas. Such an attitude does much more harm than open hostility, and clogs the wheels of progress utterly.

When Dr. Rideal read a paper recently before the Association of Managers of Sewage Disposal Works he certainly received more sympathy from the practical men than from the other engineers who discussed his paper. That a chemist should suggest that nitrates required in the manufacture of explosives for war purposes might be obtained from sewage at once aroused interest, but because the working out of the problem was left to engineers, and they were asked to make a fresh mental effort, a very serious and important suggestion was treated as being impracticable. This was clearly not because of its impossibility, but because it would certainly require keen effort, thought, and imagination such as would undoubtedly be given to it by engineers in a new country. Immediately the old objections of expense and of the difficulty of adapting existing methods to a new process were heard, and nothing else. Here we have a case in which the chemist has shown us that a material which may be of priceless importance to the country before the war is over exists in large quantities in our sewage; that it may be gathered from effluent by the simple method of evaporation, and as a crude illustration he imagined a simple tank and natural evaporation, leaving it to the engineer to suggest something better. As an asset towards the cost of such a process we have the great value of nitrates, and for the rest under certain conditions we should have the resources of the nation. For a new idea this is by no means a bad start. Surely the suggestion is deserving of very serious consideration, and in publishing Dr. Rideal's paper we hope that we shall be appealing to a large number of engineers who will have sufficient imagination to see the possibilities of the suggestions brought forward.

It is not necessary to point out that our greatest modern developments have started from ideas which were considered to be utterly impracticable by those who first had to deal with them. We can laugh at those who opposed sewage effluent and water sterilisation, who only recently believed flying to be impossible, who regarded the electric railway as a toy, and the submarine as the wild dream of a French author, but we should be careful not to fall into similar errors at the present time. An idea such as that brought forward by Dr. Rideal is deserving of the greatest respect, and merits careful thought and study. Had Dr. Rideal talked about the preparation of a new artificial manure from sewage we should have grasped the idea readily, because that is something we have thought about already, but a newer idea demands a fresh mental effort, and this is more difficult. Those who have grown too old to have new thoughts—and this condition sometimes occurs at an early age—will adopt the complacent retrospective attitude and refuse to think, but those whose minds are young and receptive, and who are capable of fresh efforts, will be in sympathy with the author.

* * *

Housing after the War.

At the last meeting of the Town Planning Institute, Councillor Harrison Barrow, the chairman of the Birmingham Tramways Committee, read a paper of great interest in which he dealt with the problems in connection with housing and town planning that will have to be met after the war. The position in regard to housing is certainly serious. Taking into consideration the admitted shortage of housing accommodation before the war, and also the practical suspension of house building for the past two and a-half years, it may be safely estimated that, with the earliest possible termination of the war, something like 300,000 new houses will be urgently required. In addition, it may be said that there are considerably more than 500,000 existing houses up and down the country that are, according to every modern standard, unfit for human habitation. The question then at once arises as to how far private enterprise may reasonably be expected to meet this colossal need. Everything seems to point to the conclusion that speculators will be unwilling to risk their capital in building enterprise when the present high prices of materials renders it virtually impossible

to fix a rent which is at once remunerative and within the means of prospective tenants. We have on more than one occasion expressed our own conviction that some form of State aid will be necessary, and we need say no more as to this at the moment.

Councillor Barrow also had a good deal to say on the vexed question of compulsory town planning. His opinion is that compulsory town planning, as ordinarily understood, would prove to be so elaborate and lengthy a process that much avoidable evil would be done in any given case before it could be achieved. The expedient which he suggested for getting over this difficulty is certainly worthy of the most careful consideration. It is that every town and urban district should be compelled to prepare maps showing three zones: (*a*) The areas which have been developed for building purposes, where the roads have been constructed and the land completely laid out for building purposes; (*b*) areas where the land has been partially laid out for building purposes, with roads laid out and partially constructed; (*c*) areas where the land has not been developed for building purposes. The Local Government Board would examine the plans and give a final decision as to the areas of these zones, for each of which a maximum density of buildings would be fixed, and would come into operation at once pending the preparation and sanction of a full town planning scheme. This is, *primâ facie*, a very practical and useful suggestion, for the compulsory adoption of the principle of density would be an immense step forward in town development, and at the same time would not operate as a bar to the preparation of formal and elaborate town planning schemes in the future. We hope to reproduce Councillor Barrow's paper in our issue of next week.

* * *

Waste Land and Food Production.

Definite facilities for the utilisation of waste lands for the purposes of food production have at length been provided by an Order made by the Board of Agriculture under the Defence of the Realm Regulations, and it is to be hoped that local authorities will not be slow to make use of the powers thus put into their hands. Briefly, the Order, which is dated December 8th, empowers allotment authorities to take over unoccupied and common land and use it for the production of food. According to the circular issued by the board, possession may be taken at once of any unoccupied land (except gardens or pleasure grounds usually occupied with dwelling-houses), while occupied land may be taken by agreement with the owner and occupier. The taking of common land is properly subject to certain restrictions. Thus, it may only be taken with the consent of the Board of Agriculture, and it is intimated that consent will not be given to any scheme which will cause material damage to the natural beauty or amenities of the common or seriously prejudice the interests of the commoners or the public. Moreover, consent will not be given unless the board are satisfied that the local demand cannot reasonably be met from other classes of land. As much of the available land consists of vacant building sites and the like, considerable expense will be involved in its preparation for cultivation—expense which authorities would reasonably be loth to incur unless there were some limited form of security of tenure. This point is met by a provision that the period of occupation may be extended when necessary for securing any annual crop growing at the end of the war; so that although cultivators cannot count with certainty on more than one year's crops from the land, this should be sufficient to repay the cost of the labour in preparing it and of the seed and manure. In the case of unoccupied or common land a merely nominal rent will be charged to the cultivators, but where the authorities themselves have to pay a rent, they will recoup the sum so paid from the allotment holders. The Order and its accompanying circular deal with a number of other matters of detail, and it concludes by urging that, in view of the national requirements, no time should be lost in putting the new powers into operation. An energetic prosecution of the scheme will materially assist the Government in dealing effectively with the food question.

* * *

Town Planning and Arterial Roads.

At the Leeds conference of the National Housing and Town Planning Council the arterial road problem was dealt in the form of a resolution, moved by the city engineer of Leeds, Mr. W. T. Lancashire, which, while recognising the need for improved arterial road construction and the value of the Town Planning Provisions Act in enabling arterial road schemes to be planned and carried into effect at a minimum cost, appealed to the Local Government Board for the establishment of a series of district conferences to examine and report on the subject. Mr. Lancashire certainly put in a powerful plea for some such procedure as is proposed. Large cities like Leeds, Sheffield, and Bradford have, he said, spent millions in rectifying the shortcomings of the past, and are availing themselves of the powers given by the Town Planning Act of 1900 to devise how the remainder of their areas should be developed. So strongly does he feel on the subject that he stated he would welcome compulsion in growing areas where the local authority did not move of its own accord. Leeds and other cities had, he continued, widened their main roads up to the city boundaries, while the smaller communities outside had had a lesser outlook, and had permitted building up to the frontage lines of narrow streets. Later on, of course, when these smaller areas were included within the cities, the enlarged city had had to face a great expenditure which should never have been necessary if proper action had been taken in the first instance. The case for the smaller authorities, so far as we can gather from the discussion, was that it would not be to their interest to incur expense on road widening over and beyond their own requirements. It is this limited view which Mr. Lancashire combated so vigorously, and it is obvious that there is a good deal to be said for a liberal and enlightened outlook in considering the problem of arterial roads. We are even beginning to lose a great deal of our timidity with respect to the term compulsion in these days, and not altogether without reason. In any case it is quite certain that district conferences officially convened might be of great utility, and the conference did well in appealing to the Local Government Board to render assistance in arranging for these where the necessity may happen to arise.

* * *

Munition Works and Rivers Pollution.

A statement of a most important character was made by Lord Desborough, the chairman of the Thames Conservancy Board, at the last meeting of that body in regard to the deleterious effect of discharging the unpurified wastes from munition works into the rivers of the country. In many places, particularly in the Midland counties, there has been terrible pollution from this cause during the past few months; so much so, indeed, that it has been said that the work of purification has been put back for at least twenty years. And now, by a clause in the Acquisition of Lands Bill, the Government propose that the Railway and Canal Commissioners—a body having no experience

whatever of purification work—shall be the authority to decide whether rivers have been contaminated or not. The case of the Thames is of special importance, because it is the source of supply of about two-thirds of the drinking water of the Metropolis. It was only fitting therefore that Lord Desborough, as chairman of the Thames Conservancy Board, should have been the prime mover in an attempt to secure some more satisfactory arrangement. Under the Bill as drafted the board would have had to prove that pollution had actually occurred before any action could be taken. It is evident that if this provision were allowed to stand it might lead to the most serious consequences in the case of any river from which a public water supply is drawn. It is essentially a matter in regard to which prevention is not only better than cure, but is absolutely necessary if the public health is to be maintained. It is satisfactory to know therefore that, as a result of opposition to this provision, the Bill has been postponed for a week, and that when its consideration is resumed an alternative clause of a less dangerous character will be submitted. The design of the Bill as originally drawn was, of course, to facilitate the erection of munition works on the banks of rivers. While everyone agrees that in the national interest all our energy must be devoted to supplying our armies in the field with the means of victory, it must not be forgotten that one means of securing this end is to take all possible steps to safeguard the health of the munition workers. Lord Desborough is to be congratulated on the wisdom of the stand he has made in this matter.

* * *

A Building-line Case. A case of considerable interest to municipal engineers was recently decided at the Tamworth County Sessions, when Mr. Musson, a builder, was summoned at the instance of the Tamworth Rural District Council for an alleged offence under sec. 3 of the Public Health (Buildings in Streets) Act, 1888. It will be remembered that the section provides that it shall not be lawful in districts to which it applies, without the written consent of the local authority, to erect or bring forward any house or building in any street beyond the front main wall of the house or building on either side thereof. There was no dispute in the case as to the fact of encroachment, the only question being as to whether or no a "written consent" had been obtained from the council as provided by the section. The written consent upon which the defendant relied was an entry in the "minutes" of the council approving the plans which showed where the building-line was to be. It was contended on behalf of the council, however, that this did not constitute a "written consent" within the meaning of the section, because what passed in the council was never communicated officially to Mr. Musson. Subsequently, after inspection of the site the resolution of approval was rescinded. After a lengthy hearing the magistrates dismissed the summons, holding that the written consent of the council to the building-line had been given by the approval of the deposited plan on which it was shown. They agreed, however, to state a case for the opinion of the High Court. Since the hearing the council have decided to appeal, and the result will be awaited with interest, as the point is one of considerable general importance to municipal engineers.

* * *

A Vacant Surveyorship. The present zeal for strict economy in municipal administration leads occasionally to very strange results. For example, it was seriously suggested at a recent meeting of the Dorking Urban District Council that the departure of Mr. Clegg, the surveyor, to take up his new appointment at Littlehampton should be made the occasion of an "economy" by simply not appointing a successor! In addition to the not unusual suggestion that the best interests of the ratepayers would be served if the department were run by the road foreman, one member stated that they had an "assistant surveyor" in the lady who does the clerical work of the office. Happily, the chairman of the special committee appointed to consider the question took a more enlightened view, and pointed out the incongruity of expecting a road foreman to prepare plans, specifications, and estimates, or to deal with an anticipated claim for extraordinary traffic. Ultimately the opinion of the committee that the interests of the town will be best served by filling the vacant offices of surveyor and inspector of nuisances was endorsed, and it was resolved to advertise for a whole-time officer at a salary of £250. This result was not reached, however, without disposing of an amendment suggesting a lower salary. As usual in such cases, it was the salary as surveyor that was to be reduced, and not that as inspector! We are firmly convinced that the payment of the moderate salary ultimately decided upon will prove to be a real economy in the long run. It is always a mistake to attempt to run the chief spending department of a local authority on the cheap.

* * *

A Question of Revenue. We observe that by a resolution recently adopted by the Wimbledon Corporation all employees and officials receiving a payment by way of salary, wages or otherwise, of more than £2 at any one time shall be required to pay for a receipt stamp to be affixed to the receipt taken for such payment. It has been suggested to us that receipts for wages form an exception to the general rule that receipts for amounts exceeding £2 must bear a stamp, but we know of no authority for this. On the contrary, the law appears to be clear that receipts for all payments exceeding £2 must be stamped. Presumably the resolution passed by the Wimbledon Corporation refers to a change in the incidence of the cost of the stamp as between the employee or official on the one hand and the corporation on the other. Assuming this to be the case, it is impossible to quarrel with the decision, as the obligation to provide the stamp is clearly imposed by law upon the person who gives the receipt, and not on the person who takes it. None the less, the employees and officials concerned seem to be entitled to some sympathy in having even this small extra charge on their limited incomes, for in these days of abnormally high prices every penny must be taken into consideration in making the weekly or monthly budget of the man of limited means.

Contract Versus Direct Labour on Devon Main Roads. For some time the Bridges and Main Roads Committee of the Devon County Council have had under consideration the attitude of the Crediton Rural District Council in refusing to abandon the practice of employing contractors to carry out certain manual work on the main roads, which the committee are strongly of opinion should be done by direct labour. The committee last week reported that they have decided for a period of twelve months to acquiesce in the Crediton Rural District Council continuing the contract labour system, on the understanding that they will forthwith supplement this system by employing such additional day labour (not necessarily whole-time labour) as the committee may reasonably consider necessary. The committee have also agreed to an arrangement by virtue of which the whole of the main roads in the district will be placed under the supervision of Mr. Sharland, one of the district surveyors, subject to his having a competent foreman to assist him in the work.

Can Explosives be made at Sewage Works?*

By Dr. S. RIDEAL, F.I.C., F.C.S.

Some years before the Franco-Prussian War of 1870—in 1865—there was passed in England a Sewage Utilisation Act which suggested that local authorities might combine to utilise their sewage and so protect the rivers from pollution. During the Franco-Prussian War the first sewage filters were put down at Merthyr Tydvil by Bailey Denton, after Sir Edward Frankland, one of the Royal Commissioners on Rivers Pollution, had shown that downward filtration in filter-beds gave similar results to land treatment, after the removal of the suspended solids by upward filtration, chemical or other sedimentation in tanks. The recovery of nitrates from sewage by artificial filters, and from sewage polluted land, had been known much earlier, and, in Lavoisier's time, gunpowder was made in Paris from the nitrates of excrementitious origin. How far at the present time sewage is of value to our enemies is not known, but we know that fats and nitrates are contraband of war, and that they are necessary ingredients in modern explosives.

I regret that I am not in a position to give details of what has been done by our enemies in this sewage utilisation for war purposes, but I can indicate some of the directions in which useful work can be undertaken in this country and show how, when a country is faced with a shortage of fat and nitrates, the municipal sewage works, like the gasworks, can do their bit in carrying on the war.

Before the introduction of smokeless powder, nitroglycerine was used for blasting gelatine and by sappers for mines, but now that it forms an ingredient in the cartridges of most small arms ammunition the value of the glycerides is enhanced in war-time, and the recovery of fats, which frequently give rise to trouble both in small and large installations, seem to become economically possible, if not a war necessity.

FATS IN SEWAGE.

It must not, however, be forgotten that, if lessons in war economy are really learnt by the nation, the quantity of fat wasted and collected in grease traps and in sludge will be considerably less than in peacetime, and that these factors will have an important bearing on the problem.

A good deal of the unconsumed fat finds its way to the refuse destructor instead of the sewage farm, but I know of one or two military camps where the recovered fat from the detritus tanks and sedimentation tanks is now usefully collected and refined for glycerine recovery.

On the other hand, cases have recently occurred in which millions of rotten eggs, the yolk of which contains 50 per cent of fat, have been forced into the sewers, and hundreds of cases of bully beef, containing 1 oz. or 2 oz. of fat per tin, have either been buried or consigned to the incinerator and thus wasted.

In the Ninth Report of the Royal Commission on Sewage Disposal (Vol. II., p. 160) are given some figures for the grease in sludge, and these show that from pressed dry sludge as much as 8·0 per cent of fat can be extracted by a suitable solvent. The lowest figure is 3·51 per cent, and an average figure for peace-time sludge may be 5 per cent.

The quantity of solids in sludge is best calculated on the population rather than the volume of sewage, as this eliminates the differences in the volume per head of different cities. Medcalf and Eddy show that this figure for chemical sludge (which, of course, is higher than that from septic or sedimentation tanks) may be taken at about 224 lb., or 2 cwt., per 1,000 population, and we thus get on 5 per cent of fat units 100 cwt. of fat per 1,000,000 population.

At the present time we might assume that camp sewage is richer in fat than that of towns, but, taking them as equal, the total may be roughly estimated at 400 cwt. daily from camps and 4,000 cwt. from the rest of the population.

This quantity of grease is not necessarily all glyceride, but there is no doubt that, along with unsaponifiable oils, there is a fair amount of animal and vegetable fat which would give glycerine if properly hydrolised.

I think, however, that one cannot calculate on more than 20 per cent being saponifiable, and this, with 10 per cent of glycerine recovery, gives only 8 cwt. of service glycerine, as against 80 cwt. obtainable daily from all the civil sewage.

These maximum figures may seem small, but glycerine is now unobtainable even from the Ministry of Munitions.

GREASE AND BACTERIAL ACTION.

Grease resists bacterial action for a long time, and accounts for the sludging-up of filters and land. It forms the unsightly sleek in our harbours, and probably detracts from the manurial value of our sludge cakes. We should welcome its removal.

Grease traps in private houses have always been a fruitful source of discussion among sanitary engineers. Dr. Fowler drew attention to the Kresner and Eric Merten recovery traps in 1911 (J.S.C.I., 1911, p. 1343), and Mr. Tuke, in his paper on country house sewage purification (Surveyor, 1912, Vol. xlii., p. 335), insists on their importance. The sewage from our camps is especially rich in fat, and, as already mentioned, it is being recovered at some which I have visited; but, of course, town sewage varies in its fat content, while towns like Bradford and Oldham have shown the way for systematic fat collection from their exceptional sewages for many years.

At Bradford, before the war, the fat recovered was from 12 to 15 tons per day, and was valued at £8 to £10 per ton, and the cake, after hot pressing to recover this fat, was still of some commercial value.

I remember reading a description some years ago of a slaughter-house in Germany—at Quedlinburg—where this particular trade effluent was treated in such a way that 70 to 80 kilos of fat were recovered and sold per month. I doubt if they are doing this business now. In Dresden, the year before the war, the sludge was being separated from the sewage mechanically, and after partial drying it contained 13·35 per cent fat, which was extracted by ethylene trichloride solvent (*Wasser and Abwassen*, 1913-14, p. 377).

Before the war a plant at Cassel for extracting the fat by benzene after acidification was abandoned.

Dr. Maclean Wilson can tell us better how the magma is recovered from the seak tanks on the Batley Beck, and Dr. Grossmann's plant at Oldham, which distils off the fats and oils by steam from the dried sluge after being acidified, will be familiar to our Northern members.

I conclude, however, this part of my subject with the thought that our fat supplies are not exhausted, and that this reserve is not likely to be required.

If the fats from sewage are not economically recoverable at the present time, it should not be forgotten that their retention in the sludge renders it more useful as a source of energy, and if I had the time I should have liked to have reviewed the attempts to utilise the heat value of the organic matter in our sludges.

WASTED GASES.

Much progress has been made in recent years, and many of us remember the explosions which took place in some of the closed septic tanks in the early days when they were of no military importance.

These gases are derived from the anaërobic decomposition of the organic matter in the sludge, and have hitherto hardly been utilised. They consist largely of methane, and may be 2 or 3 per cent of the volume of the sewage from which they are derived. When septic change does not take place, the equivalent organic matter remains in the sludge and thus increases its calorific value; when formed in Imhoff or Travis tanks they are also combustible. Analyses of the gases from the Atlanta Imhoff tanks have shown 8 per cent of hydrogen and over 80 per cent of methane. When sludge is activated with air these gases are not formed or are lost.

Cavel, in 1912, in Paris, studied the formation of gas from the sludge. He mixed the dried sludge with 20 per cent of coke and obtained 81·7 cubic metres of producer gas having 3,500 calories per cubic metre. In his experiments he used the gas so formed for drying fresh portions of the sludge, and calculated that from Paris and the Seine Department 300 tons

* Paper read at the annual meeting of the Association of Managers of Sewage Disposal Works, held in London on the 7th inst.

of dry sludge could be obtained per day, giving 24,500 cubic metres of gas, worth 417,000 francs per annum.

To utilise these gases for war material, the Hensler engine seems best adapted for further study. In it the explosion takes place in excess of air, and the oxides of nitrogen formed, as in an arc lamp, are rapidly removed to a cooling chamber to prevent their decomposition.

When absorbed in a water tower weak nitrogen acids are produced without the employment of sulphuric acid, and thus a direct fixation of atmospheric nitrogen to nitric acid could be effected by the waste gases from our sewage works. I will not venture, from the data I have given you, to make a calculation, as in the case of glycerine, of the metric tons of nitrate that could be obtained in this way, as, fortunately, in this country at any rate, fuel for gas producers will outlast this war, but in beleaguered Bucharest, after a prolonged siege, such a device might be turned to advantage.

UTILISATION OF SEWAGE NITROGEN.

I must now turn to the most important part of my subject—viz., the conversion of sewage nitrogen into available nitric acid.

The utilisation of sewage nitrogen is no new problem. Sir William Crookes, many years ago, said: "We have the startling fact that in the United Kingdom we are content to hurry down our drains fixed nitrogen to the amount of no less than £16,000,000 per annum. This unspeakable waste continues, and no effective and universal method is yet contrived of converting sewage into coin." At the time of this calculation nitrate of soda was worth 27 10s. per ton, so that nitrogen even then was over £50 per ton. Mr. Ashton referred to this waste in his interesting paper on sugar from sewage in 1910 before the Manchester branch of your association. It would take me too far afield to discuss whether in wartime we ought to import nitrogen as wheat or as nitre, as the taxation of land values and the problems of transport and freights must be foreign to the business of this meeting.

I can give you some figures which show the enormity of the problem which you can better appreciate.

One hundred thousand persons produce on the average 90 grms. per person per day of fæces and 1,170 grms. of urine, equivalent to 3,300 tons per annum of solids and 43,000 tons of urine. The nitrogen in fæces is 1 per cent, in the urine 60 per cent. We have therefore 33 tons of organic nitrogen in the solid fæces and 258 tons in the urine.

Our military camps could furnish 11,640 tons per annum and the civil population 116,400 tons if all the nitrogen could be converted.

We may get a total nitrogen figure direct from sewage analyses. A fair figure to take is 5 parts per 100,000, or 5 lb. per 10,000 gallons at 40 gallons per head or 250 persons, so that a military camp of 4,000,000 could furnish 80,000 lb., or 40 tons a day, or 14,600 tons per annum.

It is, of course, a war secret how much nitric nitrogen is required by the belligerents per annum, but we know that the Chili exports have now all been diverted from Germany, and that in the past we have relied on this source, while the Central Powers have had to improvise their raw material.

The Badische Anilin and Soda Fabrik have published their output of sulphate of ammonia by their Haber process of synthetic production from atmospheric nitrogen as equal to 300,000 tons, which is equivalent to 62,000 tons of nitrogen per annum.

This synthetic sulphate of ammonia in Germany is now being converted into nitric acid by the Ostwald process to replace the Chili nitre which the Allies have commandeered. My figures show that in sewage we have twice as much nitrogen available, but not yet utilised, already in combination, either as ammonia or in organic form.

RECOVERY OF AMMONIA.

How can this ammonia be removed from our sewage? It is not like extracting gold from seawater, as we have all of us smelt it at our works, and many of us have determined the amount in our laboratories.

I suggest the recovery of the free ammonia by one of two simple methods—(1) Its removal by heat; (2) its removal by air.

(1) *The Removal of Ammonia from Sewage by Heat.*—It is common knowledge that heat exchangers can be now designed to work with a very small loss of energy, and that the removal of the free ammonia from a tank effluent is therefore not an impossible task. The addition of lime to ensure the freeing of any ammonium salt may be necessary, and the effluent, after being "de-ammoniated," could be further purified by filtration or land treatment.

(2) *The Removal by Air.*—Sewage treatment by aëration and activation is now one of the recognised methods, and has been tried in many places in this country and America. The colloidal and suspended matters form a sludge which is especially rich in nitrogen, and the effluent contains nitrates before filtration. It would seem that the air treatment thus brings about a rapid evolution of carbonic acid and nitrification, so that the escaping gases will not, under ordinary conditions, contain any ammonia.

When, however, air is aspirated through an ordinary sewage, the ammonia is removed by the air, and I suggest that if the "activation" be carried out in presence of lime, nitrification will not be so complete and some of the ammonia will be present in the escaping gases.

Copeland, at Milwaukee, has recently discussed the question, "Is the Recovery of Nitrogen in Sewage Sludge Practicable?" and shows the nitrogen changes of Milwaukee City sewage by Imhoff and activated treatment as follows:—

Parts per 1,000,000.

		Sewage	Imhoff effluent.	Activated effluent.
August	N as NH_3	14·6	16·2	·38
September		13·5	15·4	5·7
		14·0	15·8	4·7
August	N as N_2O_5	·13	13	6·0
September		·14	·09	5·01
		·135	·11	5·5
August	N as Organic	29	27	6
September		29	27	9
		29	27	7·5

At Milwaukee 0·25 cub. ft. of air per minute per square foot of tank surface, with a period of four hours' aëration with a sludge content of 25 per cent, is being adopted (*Engineering Record*, 1915, 481).

We see that (these are parts per 1,000,000, but, as American sewage is ten times weaker than English, the foregoing figures are comparable with ours at part per 100,000) the Imhoff effluent is very similar to the raw sewage, but that the activated effluent has more than half its ammonia oxidised, while only 25 per cent of the organic nitrogen is retained. The sludge is richer in organic nitrogen by this latter amount, but some of the ammonia—about 5 parts—must be removed by the air.

If air be passed through the sewage or the Imhoff effluent without nitrification taking place, 10 parts per 1,000,000 of ammoniacal nitrogen should be present in it. Experiments are required to ascertain the conditions which have prevented the removal by the air of the residual 4·7 parts of ammonia in the activated sludge working.

Its subsequent recovery as sulphate of ammonia should present no difficulty, as the absorption of gaseous ammonia from the exhaust air by sulphuric acid is common practice in gasworks.

Mr. Copeland points out that the organic nitrogen of the original sewage passes away in the effluent from the Imhoff tank, but is retained by the activated treatment in its sludge.

This sludge is therefore the richest in nitrogen, and has the greatest manurial value. From the point of view we are now discussing, there is little possibility by any of the known processes of converting the organic nitrogen of sewage directly into ammonia or nitric acid in a form available for explosive manufactures, except destructive distillation.

Dried activated sludge (with 10 per cent moisture) contains, according to Copeland, 5 to 9 per cent of nitrogen, and such a sludge if retorted should give higher yields of ammoniacal liquor than are obtained in gasworks from ordinary coal.

NITRATES FROM EFFLUENTS.

My last suggestion deals with the recovery of nitrates from effluents.

The American weak sewage gave us 5 parts per 1,000,000 of nitric nitrogen in the activated effluent. In England our best bacterial beds give us up to 10 parts per 100,000.

In 1898 I made my first analyses of a camp effluent, that from the Caterham Barracks, where we then had a raw sewage with 17·2 parts of total nitrogen, and after

a very efficient filter (put in by one of your past-presidents, Mr. Moncrieff) I found over 50 per cent—viz., 9·0 parts of nitric nitrogen in the effluent. There were still 5·0 parts of unoxidised ammonia, and this could easily be oxidised, making 14·0 parts of nitric nitrogen, or 14 lb. per 10,000 gallons, equivalent to 85 lb. of nitrate of soda per 10,000 gallons.

The natural concentration of sodium nitrate solutions in Chili might give us suggestions for the evaporation of this large volume of water. A filter-bed with no effluent drain protected from rainfall, if irrigated with such an effluent, would gradually concentrate the nitrate, and this season at each works we could ascertain the rate of evaporation under our climatic conditions.

If in a cucumber frame, 6 ft. by 4½ ft., 3 gallons could be evaporated per day, the earth at the end of a year would contain 9·3 lb. of nitrate of soda. Drying sheds can also be heated by waste steam from the destructors, and a few degrees is often sufficient to raise the temperature above the wet bulb and thus ensure constant evaporation even on days when the air is saturated.

America, although not fighting, has grappled with the problem this year, and is determined to create her own nitrate supply. I understand the Government have granted $20,000,000 towards founding the new industry.

Our Local Government Board should encourage the municipalities to conserve this nitrogen, and I hope I have suggested several directions in which such Government help to the sewage works would not be money spent in vain.

RESPONSIBILITY FOR A SUBSIDING FOOTPATH.

An interesting point in regard to the law relating to footpaths (the *Darlington Echo* reports) was mentioned at the Stokesley, Yorks, Rural District Council meeting recently.

The field footpath between Stokesley and Great Ayton has at one point subsided, owing to the undermining action of a stream running alongside it, and the surveyor (Mr. W. H. Dixon), who had been asked informally—the council having no direct responsibility in the matter—reported the cost of reinstatement would be £150.

The chairman (Mr. S. Wiggins, J.P.) said counsel's opinion had been taken on the matter, and it was that while the rural district council were liable to repair the surface of the footpath they were not liable to reinstate the path after it had been washed away, nor was the owner of the land. The footpath ran alongside a hedge, and the position was, while the public had a right of way to pass on the right side of the hedge going from Stokesley to Great Ayton, if the footpath was allowed to go, the public would have no right to go along the other side of the hedge.

The clerk (Mr. W. Lowther Carrick) said the landowner, Mr. Wynne Finch, would be inclined to make a contribution towards the cost if the Great Ayton Parochial Committee, who had first moved in the matter, did the same. Otherwise they would lose their footpath.

Mr. G. Whitehead (Great Ayton): It is a public footpath, and I think the public authorities should come to some amicable settlement of the difficulty.

Mr. J. R. Clapham, J.P., said the footpath was a great public convenience, and the rural council should not object to subscribe if other people interested did the same. He moved that the estimate and plan be referred to the Great Ayton Parochial Committee for their opinion, and this was agreed to.

Water Supply for Steam Wagons.—Automatic apparatus for supplying water to steam wagons is to be installed in various parts of Blackburn.

The Sheffield Corporation's Electricity Bill.—Under the head of Parliamentary business it was reported, at a meeting of the West Riding Rivers Board last week, that only one Bill affecting the board's work was likely to be put before Parliament in the coming session. In a Bill promoted by the Sheffield Corporation in connection with the construction of new electricity works it was proposed in regard to the use of waters of the River Don to exempt the corporation from all or any of the provisions of any Act applying to the river. The board thought this clause much too sweeping, and authorised the Parliamentary Committee to keep a watch upon the Bill.

LOWESTOFT SEA DEFENCE WORKS.

THE TOWN COUNCIL AND THE EMPLOYMENT OF CONSCIENTIOUS OBJECTORS.

At the meeting last week of the Lowestoft Town Council the borough surveyor, Mr. G. H. Hamby, reported to the Sea Defence Committee that for a long time he had experienced trouble about men for this work. He had made a report to the town clerk, who had seen the Local Government Board, but they held out no hope of getting any men back. The subject of employing conscientious objectors (the *Eastern Daily Press* reports) was again raised, and the board were of opinion they could find them useful and suitable men. The town clerk reported as to his interview with Sir Noel T. Kershaw, assistant secretary of the Local Government Board, who suggested the employment of conscientious objectors according to conditions already reported. The town clerk was directed to apply for twelve men (conscientious objectors) suitable for sea defence works, and it was referred to the town clerk and the borough surveyor to make all the necessary arrangements.

Mr. A. B. Capps, in moving the adoption of the report, said they could not get on as well as they wished owing to the scarcity of labour. They had appealed for conscientious objectors, but his opinion was that if they refused to fight on the land, they would not fight the sea. Still, they must drop prejudices.

Mr. A. Evans moved as an amendment that the clause referring to the conscientious objectors be deleted. He was surprised that such a proposal should emanate from the borough surveyor, and be backed up by five members of the council. To employ cowardly skunks—he could not call them other names—would be an injustice to the borough. They were ready to receive the benefits of the country so long as they were not asked to help. But as soon as the country needed them they had a conscience. They could not work for 1s. 2d. a day; but they would if they got 7s. a day. He noticed that the Cardiff Town Council had decided to dismiss all employees who had a conscientious objection. In view of that he could not think that Lowestoft would agree. If they did engage the men, then he felt so strongly in the matter that he would be determined to urge the other men to down tools and refuse to work.

Mr. C. Thrower seconded, and said the town council would do a lot of harm if they employed the men.

Mr. Todd said he felt inclined to go down and drive the men into the sea if they were employed.

Mr. Cockrell: I don't think you would get them to work.

Mr. Capps said he objected to the statement that these men would receive 7s. a day. They would be under the military, and would only receive the Army pay. They must bear in mind the necessity of the work. They had no labour. What were they to do if they did not get this labour?

Mr. C. Thrower: Send for German prisoners.

Mr. Capps: Yes, I would like to see that. It is an admirable suggestion. Anyhow, they could not let the question of sea defence go. They must attend to this wall; if not, then they must have some other alternative. It was not the personal wish of the committee to employ the conscientious objectors, but the work must be done, and how could they do it without the labour?

Mr. B. S. Bradbeer said they admired a Quaker, but they could not tolerate these conscientious objectors, who had a conscience to gain their own ends. He objected to such men, and Lowestoft was too loyal to employ such men. Lowestoft had given of her youngest and best, and if such men were brought here they would be spurned, kicked and spat upon. That would serve them right.

The mayor: It is evident that after this debate it would be detrimental to the town to employ these men. He advised that they should agree to delete this clause.

The amendment was carried, and, with the clause deleted, the report was adopted.

Gas and Electricity Charges at Paisley.—At their last meeting the town council agreed to increase the price of gas by 1d. per 1,000 cub. ft. for all supplies, except by prepayment meter, and to increase the charge for electric lighting by ½d. per unit. A new scale of charges for power supply was also approved.

"LEATHER" BACILLUS.

By Dr. A. C. Houston.

Director of Water Examination, Metropolitan Water Board.*

The history of this bacillus may be briefly summarised. A tap on one of the pressure mains at one of the Metropolitan Water Board's works gave results which varied from time to time, but which were usually very unsatisfactory, both as regards number of bacteria (gelatine at 20-22 deg. Cent., and agar at 37 deg. Cent.) and apparently also in respect of the B. coli test. The results not agreeing with those obtained in the examination of the separate and general filter wells, it was at first thought that some impurities were entering the supply between the general filter wells and the pumps, in the pumping wells, or possibly even in the pumping main, although this latter supposition seemed to be most improbable, the water being under high pressure.

It so happened that the pressure main involved in the study was connected up with other mains in such a complicated way as to render it extremely difficult to trace exactly the source of the water, and there were other circumstances in connection with the pumping wells and brick culverts which pointed to the possibility of adventitious water entering at these points. Further, the results of the examination of samples drawn from the pumping wells and brick culverts and other pressure mains sometimes seemed to favour and sometimes to negative the possibility of adventitious water gaining entrance to the supply at some point or points. In the former case it was only necessary to conjecture an occasional wave of increased pollution to account for the results observed in connection with the tap samples, which, as previously explained, were themselves of a somewhat variable character. Yet again, there were occasions when either separate or even general filter wells showed a falling off in quality, so that the task of tracing the exact source of the trouble proved most difficult.

Eventually the pressure main was laid bare, and a new pipe and tap were affixed close to the old one, but on the proximal side—that is, nearer the pumps. It was then found that samples collected from the new tap yielded good results, whereas the old tap samples still remained unsatisfactory.

It now became practically certain that there must be something wrong with the old tap or its connections. The old tap with its pipe and connections were accordingly removed and transferred to the laboratories and affixed to a main pipe in the building.

Samples were collected under various conditions—*e.g.*, after the water had stood in the pipe for some time, after freely running the water to waste, &c. The results resembled, in every important respect, those previously observed at the works—that is, the number of bacteria (gelatine at 20-22 deg. Cent. and agar at 37 deg. Cent.) and B. coli (lactose + indol +) results were far worse than in the case of the other taps in the building examined under comparable conditions.

The tap, pipe, and connections were next detached and subjected to a most careful examination, which involved cutting the pipes into short lengths and making cultures from washers, tow, mountings, scrapings of grease, &c.

SUSCEPTIBLE WASHERS.

The next result was that the leather washer in the tap itself was eventually found to be the sole cause of the trouble.

Practically only one organism (now called leather bacillus) was concerned in the matter, as the other microbes occasionally found did not both ferment lactose and also produce indol, and they were usually present in relatively few numbers.

Moreover, it was found by repeated experiment that if bits of the leather washer were placed in tap water contained in a bottle, and the bottle and its contents sterilised by means of heat, the introduction in pure culture of the leather bacillus was followed, within a week at room temperature, by multiplication of this microbe to at least 100,000 times the number originally added. It was also found that the leather bacillus usually, but not invariably, attacked other washers in a precisely similar manner. So far, however, it has failed, with one exception (samples of best sole leather) to grow on samples of good and poor quality leather which had not been previously used for any purpose. Nor will it grow apparently on the patent non-leather washers which are sometimes used in place of leather washers. It appears, therefore, that the leather must be in what may be called a "susceptible" condition to allow the bacterial multiplication to take place.

The anxious thought naturally presented itself that if there were many "susceptible" washers in connection with taps, pathogenic bacteria might sooner or later find a lodgment in them, and, once established, continue to multiply indefinitely, because in the case of the leather bacillus there seemed absolutely no limit to the number of bacilli which could be evolved in this manner. Against this was the circumstance that places supplied with pure water do not yield tap samples containing "lactose+indol+" microbes in any number, and frequently they are absent from 100 c.c. of water. Further, an inquiry carried out in 1908 showed that, although "tap" as compared with "works" samples may contain more microbes and non-typical B. coli, the number of typical B. coli (lactose + indol +) does not differ very materially whether the samples are drawn from the actual works or from taps within the area of supply. At all events, there was a strong presumption that either there were not many taps with "susceptible" washers or, if the contrary was the case, "lactose+indol+" microbes were unable to establish their supremacy in connection with them.

The matter, however, was carefully gone into, and, working always with proved "susceptible" washers, it was found that both the typhoid bacillus and the cholera vibrio suffered gradual extinction under conditions which led to the rapid multiplication of the leather bacillus. Further, raw Thames water and tap water containing over 1 per cent of crude sewage did not, when brought into relation with "susceptible" washers, lead to multiplication of "lactose+indol+" microbes, but the reverse took place, these organisms gradually dying out.

Hence it would seem, so far as it is possible to judge from my laboratory experiments, as if definitely pathogenic bacteria (cultivated) or even the "lactose+indol +" microbes (uncultivated) of raw river water and of sewage coming into chance relation with a "susceptible" washer would not establish themselves, so to speak, as habitual tenants.

From the fact that "tap" samples have not been found to differ very appreciably from "works" samples, it is evident that "susceptible" washers are either not numerous or do not readily become a breeding-ground for passing "water microbes." On the other hand, any microbes isolated from a sample of water drawn from a tap, which fulfils the characters described under leather bacillus, B. capsulatus and B. lactis-aerogenes, may have no direct relation to the current quality of the supply, but may have established itself long antecedently in the washer and remained there multiplying for an indefinite period.

Probably the only way of overcoming this difficulty would be to have all-metal taps, or taps fitted with patent non-leather washers, or before collecting a sample of water to heat the tap to 70 deg. Cent. for ten minutes—a temperature more than sufficient to kill these microbes if established in the washer.

The matter is of small practical importance in cases where judgment is founded on the examination of samples drawn from a large number of taps, but where an opinion of real importance is to be based on even multiple samples taken from a single tap, there would seem to be the possibility of a wrong conclusion being reached.

* Extract from the twelfth report on Research Work.

Builders and Tendering.—The Torquay Association of Building Trades Employers have informed the corporation of that town that their members would decline to submit any tenders in competition for contracts invited by the corporation over the value of £300 unless a specification and bill of quantities were provided.

Professional Men's Battalion.—The Surveyors' Institution has been asked to make it known that surveyors in all branches of the profession who have now been called up for military service will be accepted for the 110th Training Reserve Battalion (late 22nd King's Royal Rifle Corps), from which a number of surveyors have already obtained commissions, and in which they will have the opportunity of being trained with other men of the professional classes. The battalion is stationed on Wimbledon Common. Applications should be made to the British Empire League, Norfolk House, Laurence Pountney-hill, E.C., letters being maked "Recruiting."

British De-Tinning Company's Scheme.

LAST WEEK'S CONFERENCE OF MUNICIPAL AUTHORITIES.

(Conclusion.)

As reported in our issue of last week, it was agreed at the first day's sitting of the conference of municipal authorities which was held in London from the 13th to the 15th inst., for the consideration of the British De-Tinning Company's proposals, to deal on the following day with the various questions raised by delegates in the course of the proceedings. Mr. E. Willis (Chiswick) pointed out the importance of the answers to the questions being published. If they were published in The Surveyor they would be read all over the country by many who were not present at the conference.

FIRST DAY'S QUESTIONS.

Among the questions submitted were the following:—

By Mr. R. H. Bicknell, M.Inst.C.E.: (1) What is the average output of waste metal per 100,000 of population? (2) What is the minimum quantity of refuse that could be profitably dealt with? (3) After the raw material has been treated what is its value to the company? (4) What are the proportionate weights of (*a*) waste tins, (*b*) light scrap, (*c*) galvanised scrap and enamelled scrap? (5) What price does the company propose to pay per ton for each class above-mentioned, and, assuming the minimum quantity given in answer to question (2), then—(6) What would be the estimated cost of maintaining the buildings and plant before-named? (7) What would be the amount paid by the company to the municipal authorities for treatment of the materials at per ton of raw material? (8) What is the estimated selling value of the recovered zinc and tin in terms per ton of raw material? (9) Can an estimate balance-sheet be prepared showing estimated capital outlay, working costs, and profit for a town of, say, 100,000 inhabitants?

By Alderman J. Wilkins (Finsbury): (1) Can the bruises be taken out of the old tins and the tins be restored for use? (2) Have you in your possession a process, chemical or otherwise, for de-tinning similar to the process in the possession of the Germans? (3) Are you proposing to appoint a committee to investigate the process?

By Mr. E. R. Capon (Epsom): (1) Can you deal with old tins, large quantities of which have been stored since the war broke out? (2) Is old burnt tin of any value?

By Mr. W. Greig (Glasgow): In your method do you deal with enamelled ware, or is it confined to old tins and galvanised articles?

By Mr. C. H. Macfarlane: As most corporations will probably prefer to make a definite and final payment to Mr. Jones for power to work his patents rather than adopt the perpetual plan of payment by royalties, will he be prepared to deal with offers on the first-mentioned lines?

By Baillie Mitchell (Glasgow): Does Mr. Jones promise that the minimum price to be paid for old tins and waste material suitable for the De-Tinning Company shall not be less than £5 per ton?

By Mr. L. D. Lewis (Abertillery): (1) What is the minimum population where the scheme could be carried out in all its branches and be commercially sound? (2) Are tins partially rusted of value in the process?

SECOND DAY'S SITTING.

Mr. D. Roberts (Swansea) occupied the chair at the second day's sitting of the conference.

THE COMPANY'S SCHEME OUTLINED.

Mr. C. T. Ruthen, speaking on behalf of Mr. Morgan Jones, further elaborated the suggestions made by the company, and pointed out, with regard to the local authorities erecting their own works, that he thought there would be many objections on the part of the ratepayers, while at present the authorities had not the necessary powers to do such a thing. The second suggestion was that the authorities should enter into a contract with the company for the sale of tinned waste for a period of years at a fixed sum per year, such sum not to be less than that paid by enemy agents in pre-war days. Mr. Jones did not desire only to have the nice straight pieces of tin, but he had in mind the taking of all kinds of scrap—bright tins, enamelled tins, galvanised ware, and in fact all the kinds of scrap one found in the dustbins. The machines for cutting the tins could be hired from the company, and the company would, if necessary, supply the labour for the machines. With regard to small areas where there might be only one or two tons a week, or even less, the suggestion would be that the local authority should enter into an agreement with the company to sell the old tins at a fixed price. The local authority would collect and separate the waste, and the company would send a travelling machine to cut, flatten and bundle the waste at stated intervals, and this might then be removed to regional works at stated intervals for final treatment. With regard to the questions raised on Wednesday, he considered there was too much red tape about such points as the proportion of waste tin per 100,000 inhabitants. The point was, "Are there any old tins from a town of 100,000 inhabitants which up to now have gone to the Germans?" Mr. Jones had the brains and the money, and was only waiting for the consent of the Treasury and the Ministry of Munitions to start with the erection of the works at Southwark. He suggested that the conference should appoint a committee of thirty, and then this committee should appoint a special supervisory committee of three to examine the methods and the processes, and to report within six months of the opening of the Southwark works. Mr. Jones would find the money for the erection of the works and the plant. He thought it was unnecessary for Mr. Jones to go into the question of the production of the waste of towns per 100,000 inhabitants. It did not matter to the local authority so long as they took no financial risk. If Mr. Jones got 2 cwt. of gold from a ton of sardine tins, so much the better for him. He might get some tin and some spelter, but the getting of these by-products had nothing to do with anyone but Mr. Jones and those financially interested. If the process was a loss, that was also a matter for Mr. Jones.

Replying to Mr. Wilkins, Mr. Ruthen said he did not suggest that the tins should be sorted. All he asked was that the tins should be separated from the ashes and cabbage leaves. He saw no reason for going into matters if they were to appoint the large committee suggested. The sub-committee would see everything in the process and be sworn to secrecy.

Mr. P. Dodd (Wandsworth) said 30 per cent of his waste was taken to the destructor, and the tins were thrown out. Mr. Jones came along and offered to deal with the tins. He offered a price greater than they got before, and also to pay part of the cost of the building, and it seemed to him a good commercial proposition.

Mr. A. E. Collins (Norwich) thought the local authorities would require to know what profit Mr. Jones was going to make. They would object to an overwhelming profit.

Mr. H. G. Whyatt (Grimsby) suggested that the company should establish works at London, Bristol, Manchester and Hull, to which local authorities could send the tins without treatment.

Mr. E. A. Mills (Lambeth) said they wanted it made clear that the cost to the local authorities of dealing with the waste material was no more than at present.

Mr. J. C. Dawes (Keighley) asked if, after the local authority had burned the tin off and baled them, the company could talk in terms of paying 50s. a ton for them instead of 17s. 6d.

Mr. A. Harrison (Southwark) said he took it that different authorities would get different prices, but they would all get more than the Germans paid for the tins.

Alderman Keay (Eastbourne) observed that his corporation used to get from £100 to £300 a year from the German company for the old tins. What he wanted to know was what they were to get for them from the company, and if they thought the company was doing too well out of it, then they were at liberty to copy the process themselves.

Mr. J. Terry (Nottingham) said his city would obtain £1,000 for its tins that year. Could the company make a better proposition?

Mr. J. A. Priestley (Sheffield) also stated that his town had got rid of his tins at a profit before and

since the war. They burned off the tin and baled the metal and sold it at 50s. a ton.

Mr. Reginald Brown (Southall-Norwood) pointed out that the fact remained that before the war the majority of the tins did go to Germany. He moved: "That this conference records its opinion that there is a vast amount of waste metals collected by corporations and others which can, and ought to be, utilised in the national interest, and that the conference offers its undivided encouragement to any British company to undertake any necessary process for the purpose of such utilisation and thereby capture from German companies a profitable trade."

The resolution was seconded and carried.

The conference then adjourned for lunch.

THREE RESOLUTIONS.

At the resumption of the proceedings the chairman took the sense of the meeting as to three resolutions placed before him. The first dealt with the suggested signing of a petition to the Government Departments asking them to allow the works to proceed. The second was as to the appointment of a representative committee to investigate the process; and the third a resolution approving of the scheme outlined by Mr. Jones, subject to the findings of the committee, and recommending that the local authorities should enter into agreements with the company.

At the request of Mr. Whyatt (Grimsby) the petitions were read. The first, to the Treasury, asked that Mr. Morgan Lewis Jones be permitted to register a company, or companies, in the United Kingdom for acquiring waste materials which before the war were sold to Germany, and their conversion into articles of use in warfare or for domestic purposes, with liberty to raise capital for that purpose. The second petition to the Ministry of Munitions asked for power to Mr. Jones to erect buildings in Southwark, Wandsworth and Southend-on-Sea for the treatment of waste metal, and for powers to be given to local authorities to erect such works if they were satisfied with the results attained at Southwark.

It was stated, in reply to a question, that the Treasury would take care that no monopoly was granted.

On the motion of Mr. Evanson, the conference adopted the petitions.

REPLIES TO QUESTIONS.

Mr. Ruthen then dealt with the questions put the previous day. With regard to the question of what machinery was required in small districts for cutting the metal into strips, he had dealt with that in the morning. Mr. James (Grays) asked the estimated cost of labour for cutting up the metal, and what the company would pay for such metal. These were questions which would be fully answered by the sub-committee to be appointed. Then they were asked if they could deal with old tins, and old burnt tins. All he could say was that Mr. Jones desired to enter into arrangements with the local authorities for the purchase of old waste. He did not desire them to do anything except to collect the tins and put them in a depot. The company would collect them from the depots. Any metal products which passed accidentally through the furnaces would be collected. Mr. Blair asked if there was any prospect of the company establishing a depot in the North of London, where there were several districts. At Wandsworth Mr. Jones had made arrangements for the erection of the building on the site of their destructor, and he had made arrangements for tins from other places to be sent to be treated there. If that could be done in other places it would be an advantage. As to the question from Glasgow as to the cost of large municipalities erecting their own works, he thought he had pointed out the difficulties of a local authority having their own works and manufacturing, and he did not think such a thing would be attempted—for a long time, at any rate. He thought they might take it that the same plant could not deal with everything. The cost of labour in cutting and baling the tin per ton depended on the amount of scrap, the kind of neighbourhood, and the kind of population from which the scrap was obtained. The price per ton to be paid was obviously one for the special committee to go into. He would tell them straight he could not give them costs, and he was not going to try. Mr. Mitchell (Glasgow) asked if Mr. Jones would guarantee to pay not less than £5 per ton for the waste metal. The point was that many municipalities had been throwing this stuff away, or sold at a nominal price. If this stuff could be dealt with satisfactorily in England why should it not be? He could not answer the question as to what would be the minimum population where the scheme could be carried out in all its branches to be commercially sound. As to partially rusted tins, all metal would be taken, but the more tin on it the better for Mr. Jones. Mr. Jones was perfectly willing to negotiate with any large corporation for acquiring the rights for a lump sum instead of the payment of royalties. They could deal with bruised tins if they were not too bad. They had a process of de-tinning similar to that of the Germans. Coming to the question of Mr. Bicknell, Mr. Ruthen said the answer to No. 1 depended on the class of neighbourhood and population. He knew a town where there was 100 tons per 100,000 population, and another where there was 200 tons. In reply to (2), it depended, again, on the neighbourhood and the arrangements the company could make with the local authorities; also upon the proportion of enamelled and galvanised goods, &c. The third question ought not to have been asked. The answer to (4) depended entirely on the proportion of the particular articles in the aggregate; as no minimum quantity was given in answer to (2) no answer could be supplied to question (5).

Mr. Bicknell said that answer was most unsatisfactory. Everyone wanted to see where they were. It did not affect large towns like Glasgow and Birmingham, but it did affect small towns.

Mr. Ruthen said the answer to (6) would depend on the size of the building and plant, and on the neighbourhood where the building was, and the amount of material collected in the neighbourhood. He said that was a sound answer. With regard to (7) neither he nor Mr. Jones had suggested that any public authority should treat any of the metals. If Mr. Jones conveyed the idea that they should, he did not intend to do so. What the Southwark Corporation undertook to do was to indicate a site near its destructor where they would be willing for a building to be erected, and to enter into arrangements with the company whereby the company purchased all the scrap tin and metal just as it came out of the dustbin. The corporation did not do more than that. If Mr. Jones gave any other idea it was a mistake.

Mr. Blair (St. Pancras) said that Mr. Jones handled the little bales of metal when he was speaking, and he said that was the form in which he wanted the tins. He also said the company would supply the machinery for cutting it up at an approximate cost of £50, which could be taken out of the value of the metal supplied to the company.

Mr. Ruthen said he dealt with the matter in the morning when he suggested that machines could be rented to local authorities, and the price per ton for the material could be the original pre-war price, plus a profit, and plus the cost of passing the materials through the various preliminary processes. Proceeding to deal with Mr. Bicknell's questions, Mr. Ruthen said that (8) was an impertinence, and as to (9) they might as well ask Mr. Jones to give full particulars of his secret process.

Mr. Terry (Nottingham) then moved: "That this conference agrees that the proposition outlined on behalf of Mr. Jones is approved of, subject to the final report of the Special Supervisory Committee of five appointed by this conference, and will, on a favourable report by such committee, recommend the local authorities represented to enter into an agreement with Mr. Jones on the lines indicated for the purchase of their waste materials for a term of years and from year to year until determined by notice to be fixed."

The resolution was carried.

Mr. E. R. Capon (Epsom) proposed: "That thirty members of this conference be appointed as a committee to select a special supervisory committee of five to arrange for and supervise Mr. Jones's demonstration, and to negotiate terms with him, and report to those represented at the conference."

The motion was carried.

On the motion of Mr. Morton (Southwark), it was decided that the nomination of the thirty members of the committee be confined to those attending the conference.

The meeting then proceeded to nominate delegates for the committee.

CONCLUDING SITTING.

Mr. P. Dodd, the borough engineer of Wandsworth, presided at the concluding sitting of the conference on Friday, the appointed chairman, Mr. A. D. Dawnay, J.P., the mayor of that borough, being unable to be present owing to illness. At the outset Mr. Dodd read the following telegram from Mr. Dawnay, the concluding portions of which were received with applause:

"Am confined to bed some days; severe cold. Much grieved and disappointed unable attend conference and you inconvenienced to choose another chairman. Am thoroughly convinced your scheme great future if energetically started. Sincerely hope works set up promptly wherever needful, strongly supported by municipal and county authorities all over country. De-tinning must never again be a foreign monopoly. All must wake up and get systematically to work or our only opportunity will for ever be lost. Not de-tinning only, but a score other important industries we have let slip out of our hands by apathetic utter indifference. Such a conference of eminently influential representatives should not disperse without calling upon the Government in the strongest possible terms to carry out forthwith the conditions of the Paris conference of Allies last June, which have been shamefully neglected ever since. I pray you to read this to the meeting. May it be most enthusiastic."

ARRANGEMENTS AT WANDSWORTH.

Proceeding to address the delegates, the chairman said he was sure they all sympathised with the Mayor of Wandsworth at his inability to be present, for Mr. Dawnay had taken a deep interest in this question, especially since the De-Tinning Company had entered into a contract with the borough council. If the mayor had been present he would have told them that the Wandsworth Borough Council had adopted the proposition of the company not only on economic grounds but also on the grounds of patriotism. At the meeting on the previous day a question was asked as to how far local authorities were to deal with the tins before handing them over to the company. In Wandsworth the arrangements they had made with the company were somewhat different to those with the Southwark and Southend councils. In Wandsworth the tins would be brought to the council's depot adjoining the destroyer; the company would then erect a building on a site which was now partly occupied by the tins, and they would provide the machinery and the labour for taking the tins to and dealing with them in the building. At Southwark and Southend the labour was to be provided by the local authorities. The company would pay his council prices, which were very much above pre-war prices, for the tins, and the council would also participate in the nett profits made in dealing with the tins inside the building on their ground. Another question was asked as to what was the proportion of the various kinds of tins. He could only give them the Wandsworth experience, and there they collected about 50 per cent of bright waste tins, 20 per cent of light scrap galvanised iron, and 30 per cent of enamelled iron and burnt tins.

In reply to questions, the chairman said that at present they had got about 150 tons of old tins in stock. As soon as the company could get the consent of the Minister of Munitions they would proceed with the buildings. The arrangement with the company was for a period of fourteen years.

A delegate enquired whether the company intended to confine its attention to municipalities, or whether they would collect from large manufacturing firms as well.

Mr. C. T. Ruthen (Swansea) said it was the intention of the company to purchase scrap-tin from sources outside the municipalities.

Mr. C. H. Croxford (Wood Green) pointed out that some of the smaller authorities on the outskirts of London collected only about 50 or 60 tons of old tins a year, and if those tins had to be sent to Southwark or Wandsworth he was afraid the carriage would be prohibitive.

The chairman said he took it that the prices for the tins would vary in different localities, and it might pay the company to give a price which would also cover the cost of carriage and still leave the company a profit.

Mr. Ruthen remarked that he was given to understand that the idea of the company was to adopt a system of centralisation for collection.

HAMPSTEAD DELEGATE'S APPROVAL OF SCHEME.

The Mayor of Hampstead said that after the explanations that had been given by the chairman and Mr. Ruthen he would have much pleasure in putting the company's suggestion before his council. The proposals were, in his opinion, very desirable on patriotic grounds, and they were very workable.

Mr. E. A. Mills (Lambeth) asked, supposing they adopted the company's scheme, and it turned out that it cost them more to deal with the balance of the refuse after the tins had been taken away, who was going to reimburse the ratepayers?

The chairman answered the question by telling Mr. Mills what they proposed to do in Wandsworth. At present, he said, 70 per cent of their house refuse was collected by contractors, and they took all the tin. That contract expired next March. He had arranged for a new contract, under which the contractors would bring the tins to the council's depot at Tooting, and he had fixed a price per ton for the work.

On the question of the price which the company would pay for the tins, Mr. Ruthen, while declining to commit himself definitely, said that 25s. per ton would be the minimum price, speaking broadly. Of course, the condition of the stuff, the total weight, and the area from which the tins came would be matters that would come into the calculation.

COMMITTEE APPOINTED.

Considerable discussion took place relative to the appointment of a committee of thirty delegates, who were to select five of their number to supervise the demonstration of the process which Mr. Morgan Jones, the promoter of the company, is to give. The Mayor of Hampstead wished to make it an instruction to the committee that the sub-committee should have at least one engineer, one business man, and one accountant on it. Other delegates suggested that Scotland should be represented, and it was also urged that the sub-committee would not be complete without having a borough surveyor. Eventually it was agreed to leave the matter entirely in the hands of the committee, and the following five gentlemen were elected: Alderman J. Wilkins (Finsbury), as representing the commercial interests; Alderman E. A. O'Bryen (Mayor of Hampstead) and Baillie Mitchell (Glasgow), representing the local authorities; Mr. A. E. Collins (Norwich), representing local authorities' officials; and Mr. J. A. Priestley (Sheffield), representing the cleansing superintendents. This sub-committee will report in due course to the committee on their impressions of the demonstration—which we understand will be arranged at an early date.

APPEAL FOR GOVERNMENT ACTION.

Before the conference closed the following resolution, proposed by Mr. Ruthen, and seconded by Councillor J. Plumridge (Wandsworth), was carried unanimously: "That this conference calls upon the Government to take action as soon as ever possible upon the lines laid down by the Paris Conference of June last, so that means may be taken early to prevent inroads into British trade and trades of the Allies by enemy countries and agents, particularly German."

At the luncheon which followed, Mr. Ruthen said Mr. Jones had asked him to thank the delegates for their attendance, and to say that he hoped he had given all the information which could reasonably be asked for.

Alderman O'Bryen proposed a vote of thanks to Mr. Jones for the trouble he had taken in bringing the process before the municipal authorities, and for the hospitality he had extended to the delegates. Amid cheers, Mr. O'Bryen remarked that he hoped Mr. Jones would be able to carry the company through to as successful an issue as the country believed his fellow-countryman, Mr. Lloyd George, would carry through the war.

The vote was carried with enthusiasm.

On the proposition of Mr. J. C. Dawes (Keighley), thanks were accorded to Mr. Ruthen for his answers and explanations of the scheme at the meeting on the previous day.

In acknowledging the vote, Mr. Ruthen asked the delegates on their return home to communicate the result of the conference to their various authorities, and if possible to get them to communicate officially with the Ministry of Munitions and the Treasury as to the advisability of allowing the company to prove the value of its process in capturing German trade.

A cordial vote of thanks was tendered to Mr. Dodd for the able way in which he had filled the place of the Mayor of Wandsworth, and the conference closed with the National Anthem.

Snow-free Footpaths in Manchester.—The superintendent of the Manchester Corporation cleansing department states that there has been a most willing response to the appeal that occupiers should sweep the snow into the roadway from the footpath in front of their premises, so that it will drain away. This is all the more gratifying when it is remembered that the superintendent usually is able to engage 1,500 men to clear away the snow, and that on Tuesday only sixty men presented themselves for the work.

Institution of Water Engineers.

WINTER GENERAL MEETING IN LONDON.

(Conclusion.)

In our issue of [illegible] we reproduced the two papers, "The Cross Hill Covered Service Reservoir for the Birkenhead Corporation," by W. J. U. Binnie, M.Inst.C.E., B.A.(Cantab.), and "The Ratio of Water-works," by Charles Collins, B.A.(Cantab.), which were presented at the course of the recent winter general meeting of the Institution of Water Engineers. We reproduced also in part the discussion on Mr Binnie's paper on the

CROSS HILL COVERED SERVICE RESERVOIR.

Other speeches were as follow.

Mr. F. J. Dixon (Ashton-under-Lyne) said he would like to ask Mr. Binnie one question, and that was why he did not divide the reservoir into two by a wall for the purpose of giving facilities for cleaning.

Mr. Edwards (Leicester) said he would like to know from Mr. Binnie whether he stuck to the old method of measuring cement by volume instead of by weight. He would also like to know the initial set of the cement used, and whether he found any difference in the hardening qualities of concrete between that which came from the old kiln and the new one. He also wished to know if he could strike the centres of the arches any quicker with the old kiln than with the new.

The Chairman remarked that they had had a long and very interesting discussion. He joined with the other members in congratulating Mr. Binnie on the design, the result, and the cost of his work. With regard to the cost it was interesting to hear from Mr. Baker that it had come out at something like £2,500 per 1,000,000 gallons. The only question he would like to ask was, What would have been the cost if there had not been any war? It had already come out at less than the contract price.

Mr. Binnie, replying on the discussion, said that first of all he had to thank them very much indeed for the way in which they had received the paper. Answering the chairman's question first, the cost that Mr. Baker had just given them was the actual cost based on the contract, assuming no war. They had no knowledge that they might not be faced with claims on account of the war—Mr. Baker's figures were the actual cost based on certificates up to date. He had to thank Mr. Priestley very much for his remarks, but, as he was dealing with the question of costs, perhaps it would be well if he replied to the other questions on that point. Mr. Roberts wanted to know whether he had obtained his information as to the cost of service reservoirs in London from Mr. Meritt's paper. The answer was in the negative. The Birkenhead Corporation wanted to get some figures, and they were supplied by Mr. Bryan, and included service reservoirs up to 10,000,000 gallons capacity, so he was not dealing with only small reservoirs. Perhaps it would be as well if he also dealt at that point with the cost of construction. It was a fact that by covering the reservoir they did not make it cost any more. He tried to make that clear in the paper. They had now got a roof to take the thrust of the side wall, which would have had to have been about 10 ft. thick at the base instead of being 2 ft. 8 in. thick if they had no roof on top to take the thrust. Therefore it did not follow that there was any extravagance whatever in covering a service reservoir if it was properly designed. With regard to the question of

AQUATIC GROWTHS

he could only speak from experience that was the Heaton service reservoir belonging to the Bradford Corporation. For many years there was never the slightest trouble, and then it was filled with filtered water, and immediately the growths came. After that experience his firm was not going to run the risk of it again anyhow at Birkenhead—as they were going to store filtered water. It must also be remembered that the water had to be stored for long periods of time. Perhaps Mr. Priestley was speaking of service reservoirs in which they run the water in and out. The reservoir was to be used as a stand-by reservoir in case of a break in the aqueduct. Whatever tendency there was for the growth of those things was intensified because the water might be left for a long time in the reservoir. As to the sand used in the work which Mr. Priestley said was not siliceous, as a matter of fact it was pure silica. There was hardly a trace of anything else in it except pure silica; it was exceedingly fine sand sharp as it looked at through a microscope. They did not exclude the finer particles which came from the crusher, and therefore a lot looked like flour, but if they looked at it under the microscope it was beautifully sharp and it made a stronger mortar than what they got with Leighton Buzzard sand. He had not got the figures in the paper, but he thought it would add to its interest if he had given the comparative tests showing what they got with standard sand and what they got with the sand that Mr. Priestley was criticising. As he had said, however, they got better results with that particular sand. He would put those figures in. Mr. Priestley asked what they did in regard to connecting the concrete on the floor. He would point out it was not a question of watertightness; the floor was merely the covering on which rested the asphalt. There was no water whatever below the floor. The thickness of the floor was immaterial—it was simply to put the asphalt on—it was the asphalt they relied on for watertightness. As to the

VENTILATION,

he could only say that his firm had constructed a reservoir with no further ventilation than they had provided in the present one, and they had never had the slightest trouble. He had seen reservoirs containing a lot of ventilating pipes, and birds went and built their nests in them. They thought that they had given a sufficient number of holes, and he did not anticipate that they would have the slightest trouble in regard to ventilation. He thanked Mr. Silcock very much indeed for his kind remarks, and also Mr. Lowcock. With regard to the inspection of the works by specialists referred to by Mr. Ashton Hill, the Birkenhead Corporation never raised the slightest objection to having anybody in for testing anything. They took care that they had specialists in for testing everything right through the job, and they never had a single word of complaint from their clients about it. As to the size of Birkenhead, he forgot the exact population; it was a county borough. He believed it was about 130,000 or 140,000; it was going very rapidly ahead, and he thought it would be a big place. He did not know about the tower—he did not know how the water engineer intended to work that. When he wanted to fill the tower he had a by-pass to the reservoir, but he did not know how he intended to do it. As to the usual reservoir design being circular, no doubt it was cheaper if they were going to have a reservoir of a certain diameter, but when they began to increase the diameter beyond a certain amount it did not help one, because one would get too great a crushing strain thrown upon the arch, and it got beyond the limit at which it was economical to use a circular design. They had to design a reservoir to take the thrust of the series of horizontal arches into which they split it up, and that was why the ordinary circular design was departed from. Mr. Roberts spoke about having too large a reservoir; he thought he was going to end up his remarks by saying they had too small a one. He (Mr. Binnie) had always been nervous about that very point. They had 4 miles of pipe laid across a marsh, which was liable to be submerged, and he had always wondered whether they had been quite on the safe side; they would certainly not care to see it any less. As to the division wall, there was a pair of reservoirs in the design, so that one could be used while the other was empty. The other reservoir would be coming along shortly to take the other half of the water. As to the question of the cement which Mr. Edwards had referred to, he did not know that he had any observations at the moment that would be helpful, but he would get some information on the point from Mr. Baker as to whether he had noticed any difference in the time of striking the centres with different classes of cement.

Mr. Edwards: What about the volume?

Mr. Binnie said he could look that up, but he could not give them any information then.

Mr. Charles Clifton, F.A.S.I., then read his paper on

THE RATING OF WATERWORKS

extracts from which were given in our issue of last week.

Mr. F. J. Dixon (Ashton-under-Lyne) said he wished to be the first member to thank Mr. Clifton for his paper, because some time ago he made overtures to that gentleman, and suggested that if he would undertake the preparation of a paper on the important subject of the rating of waterworks it might perhaps be useful to the members of the institution. The reason he approached Mr. Clifton was because he had had the pleasure of his association during the past two years in connection with the rating of the waterworks undertaking which he (Mr. Dixon) had the pleasure of administering. He found that the majority of engineers who had the administration of these works too often left the question entirely to the financial staff. That, in his opinion, was a mistake, as he considered that the engineer and the manager should be the officials to go into the question of the correctness of assessment. Referring especially to the rating of the waterworks with which he was connected, there were two very important points that arose when they were negotiating with the rating authorities to which he would like to refer. One was the question of

WORKS BUILT IN EXCESS OF PRESENT REQUIREMENTS,

and the other was the capital value versus the effective value of the undertaking. In the case which he was anxious to review, under the Parliamentary Statutes the authority to which he was referring was called upon to construct certain works so as to retain their rights. Those works were constructed at a cost of £150,000. It was part of a scheme in that particular valley which cost £500,000. Upon the completion of the works the rating authority saw their opportunity to increase the rateable value. They did so, with the result that at first they rated the £150,000 works on the total capital value, despite the fact that the authority, who were the owners of the works, did not derive a penny of increased revenue. He (the speaker) contended that such works, which were built in excess of the present requirements, should be treated as empty property for rating, the same as empty houses. The rating authority, however, did not take that view. However, they were able to convince the rating authority that they would not use the works for a considerable time, and they to a certain extent relieved them of the somewhat heavy burden of paying the full charges on the capital value. In connection with the effective value of works, as Mr. Clifton had pointed out, taking a percentage on the capital value was a very unfair method. The rating authority he (Mr. Dixon) was referring to did in the original case take the whole capital value of the works, and the result was that the capital value was far in excess of the effective value, as the construction of three reservoirs in the Pennine Chain, which was included, was very costly in carrying out the drainage works. In addition to that, the water authority was saddled with excessive works to meet compensation water requirements, and the diversion of a river, so as to comply with the conditions laid down under Parliamentary Acts for the protection of riparian owners. The compensation works were built for the benefit of the general public, and not for the benefit of the water authority in any way whatever, and he contended that the rating authorities could, for the assistance of the water authority, treat them for the poor rate on similar lines to the way in which they were treated in regard to the district rate for land covered with water—that was one-fourth of the annual value. That would give a certain amount of relief, and was justified under the circumstances. With regard to the question of

STATUTORY DEDUCTIONS,

the great point in dealing with that matter was the life of the works. He thought that the life of any work should really be based on the assumed period of its utility, and not on the period of life at the time the valuation was made. That, in his opinion, was the fairest way to take the life of any machinery. As they could readily understand, in a new works where they had a loan of thirty years, and they had only another ten years to go, it was unfair to take that life when the life of machinery might be thirty years. With regard to land covered by water, he would like to ask the author whether they should include catch-waters, as a good many gravitation schemes were supplied with catch-waters to drain waters from different districts into impounding reservoirs. Then, again, what about the tunnels which conveyed the water from the reservoirs to the towns? Surely those two items should be included as land covered with water, and get the benefit under the district rate.

Mr. D. Dinwiddy (London) remarked that, as the author of the paper which was read four years ago, and to which Mr. Clifton referred, he would like to say a few words. Before saying anything relative to the paper, he would like to say how greatly he appreciated the honour they had conferred upon him by electing him an associate of the institution. In a water company, where the principal item of the expenditure for a water undertaking was, of course, the capital charges, and next to that rates, no apology was needed for again referring to that very important item in their balance-sheets. As one of the law lords had said in the Chertsey case against the Metropolitan Water Board, the rating of water undertakings led to a good deal of fallacy, and fallacies flourished in the region of fancy. There was really no need for fallacies in the matter so long as they had got a reasonable man acting for the local authority and for the water undertaking. He thought it might be useful to refer to

THE CHERTSEY CASE.

In that case it was decided that the intake from the River Thames, which took in about 200,000,000 gallons a day, was not to be taken into account in adding to the rateable value of the works. The local authority took the total cost of the land and buildings, and took a percentage upon the land and 5 per cent upon the buildings. In addition the local authority sought to add a substantial sum of money for enhanced value over and above the percentage of cost for the value of the water taken into the reservoir. The House of Lords unanimously decided that that was not a permissible addition. Another point which arose, and upon which the House of Lords gave a decision, was a confirmation of the authority's assessment and of the Quarter Sessions' decision that the value should be 4 per cent upon the cost of the land and 5 per cent upon the cost of the buildings, allowing nothing for excessive requirements or excessive foundations or obsolescence. He (Mr. Dinwiddy) suggested there was no reason to doubt that that decision was right in that case, but it did not at all follow—and he did not think it was anything against what Mr. Clifton said in his paper—that obsolescence and excessive requirements should not be deducted from the cost—that was, the percentage for rateable value should be based upon the effective value and not necessarily upon the cost. There was one other point to which he had given considerable attention in the last quinquennial valuation in London, and that was the

EXCESS COSTS CAUSED BY THE WAR.

All water undertakings had had to suffer by having to pay perhaps 100 per cent more for their coal and a substantial percentage extra in wages. In the case of a gas undertaking or an electrical undertaking, where they had added 10 or 20 per cent to their rentals they could make up the extra cost of coal and wages, but in a water undertaking they were bound by their maximum prices. Therefore if it was a profit-earning concern the dividends must suffer—there was nothing to take the extra cost from. As the war was not likely to be over for some time, those excessive costs were likely to continue, and he ventured to suggest that they might afford a proper case for a revision of their assessments. He would like to make one suggestion to the members, and that was not to be overtroubled about a big assessment upon their works so long as the total value of their concern was not in excess of what it ought to be. So long as the total was not over the 100 per cent, it was sometimes an advantage to an undertaking to have a greater proportion put upon their works and a less proportion upon their mains, because the works, generally speaking, were right out in green fields with low rates, and the mains were very often in the centre of the cities where the rates were high. Generally the total value was divided between indirectly productive works out in the country and directly productive mains in the towns, and whatever they put on to their works ought to come off the mains, and they had got to see that it did.

Mr. O. Williams (Aberdare), after thanking Mr. Clifton for his paper, said that his works were about to be re-valued, and the valuer was asking for the lengths of trunk mains leading from the reservoirs in the direction of the town and not supplying water to an appreciable extent. He would like to ask Mr.

The Surveyor
And Municipal and County Engineer

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Clifton whether he would advise putting as much as possible on what he might call the entirely productive portion—that was the mains. He might say they all happened to be in one parish, and the point he wished to know was whether they should put as much as possible on the mains.

Mr. C. H. PRIESTLEY (Cardiff) said there was one point he could confirm the author in, and that was as to the increasing maintenance charges on works, especially with improvements. He had found that during the first twenty years on new works the percentage of maintenance charges had not been anything like what it had been after twenty years.

The CHAIRMAN (Mr. A. B. E. Blackburn), in inviting Mr. Clifton to reply, said they had had a most interesting paper, which brought the rating question quite up to date. He believed Mr. Clifton was going to advise them that it was a very dangerous thing to own their own house, and that it was much better to be a tenant instead of a landlord.

Mr. CLIFTON, in reply, after thanking the speakers for their kind references to the paper, said Mr. Dixon asked a question as to whether catch-waters and aqueducts should be included as land covered with water. That, of course, was a legal question. It was possible that some authorities would follow it; others would not. Possibly some of the members of the institution might like to take the matter up in the future. He believed the rule of the High Court upon the question was pretty definite. It must include a case where the presence of water over land was essential to the beneficial occupation of the land. If that dictum had been in force at the time the question was raised, about the year 1840, he was inclined to think that the whole of a waterworks undertaking would have been included as land covered with water, because the whole purpose of a water undertaking was the user of water. But, so far as he could find out, they got reservoirs and brick arches covered over with earth as land covered with water, but apparently by those two earlier decisions mains and pipes were not liable to be included in that category. He certainly thought with regard to aqueducts that the occupation of the land for these big aqueducts was for the conveyance and user of the water, and if the covered surface was used for agricultural purposes that user was a service user. He thought it was quite possible that works and mains were excluded, because in the early days it was held that pipes and mains were not rateable—it was

NOT A RATABLE OCCUPATION,

but simply an easement, and, of course, the dominant user of the highway was for traffic. If they studied the information he had given in his paper from that point, he thought they would see that a very good claim ought to arise for all the other works, whether they were aqueducts, watercourses, catch-waters, or service reservoirs and filters. Mr. Dinwiddy alluded to the Chertsey case, where it was held that the full cost should be taken. He thought that probably was very much on a par with the decision in the case of *Liverpool* v. *Llanfyllin Union*. That was a case of the expenditure of money every penny of which was foreseen, and they were dealing with a new property, and in that case it was only reasonable to assume that the hypothetical tenant knew what was being spent, and he had got very little to say in the matter. That meant an increased expenditure of £10,000. He knew what he was spending, but it might prove in two or three years' time that that £10,000 was only worth £5,000. Then they began to talk about effective value, and he believed the decision in the Chertsey case followed the same line of thought as the Llanfyllin case, where the expenditure was foreseen and increased, and then the question arose as to what was the proper assessment. Mr. Williams asked a question in regard to trunk mains—whether there was any advantage in having them included in the work. As the works were entirely in one parish it did not matter a bit. As a matter of fact, being in one parish, the valuer would not go into the question of apportionment at all—he would take the full value. Mr. Priestley drew attention to the increase in maintenance, and that was certainly an important point, especially with regard to waterworks. He thought the probability was that the average repairs of the past would not be a sufficient sum to provide for the repairs of the future.

The CHAIRMAN read a letter from the president expressing his regret that illness would prevent his coming to London to attend the meeting, and adding that the invitation to the institution to hold its next summer meeting at Belfast was still open should the circumstances permit.

Commenting on this, the CHAIRMAN said he thought it was pretty plain that it would be impossible to hold the next summer meeting at Belfast, and indeed conditions might arise which would prevent the meeting being held at all. The members would hear about that later. In conclusion he proposed that the best thanks of the institution be given to the president and council of the Geological Society for granting their apartments for the use of the meeting.

The resolution was carried with acclamation.

Mr. WILLIAM WHITAKER, B.A., F.R.S., in proposing a vote of thanks to Mr. Binnie and Mr. Clifton for their papers, said that as a member of the council of the Geological Society he felt honoured that two such important papers should have been read in that room. He hoped that the institution would continue to meet in those apartments for many years to come. They owed very sincere thanks to the authors of the papers, and he had much pleasure in proposing that their thanks be accorded to those two gentlemen.

Mr. C. H. PRIESTLEY (Cardiff), in seconding the motion, said he was sure they all felt that they had had two very valuable and interesting papers. While he was speaking he would like to propose a vote of sympathy with their president in his illness, together with the hope that he might speedily be restored to his normal health.

The vote to the authors of the papers was carried with enthusiasm, and the chairman said that, following on what Mr. Priestley had said, the secretary would convey to the president the sincere regret of the meeting at his enforced absence.

The proceedings then terminated.

Coast Sand Dunes, Sand Spits, and Sand Wastes. (By G. O. Case. Price 5s. St. Bride's Press, Limited, 24 Bride-lane, E.C.). . . . "A most useful little book crammed with facts culled from all parts of the world and well illustrated with photographic reproductions and diagrams. Numerous references to other works are given. Mr. Case discusses the formation and distribution of sand dunes and the devastation caused by them when they move inland, and then goes on to consider protective works and the reclamation of sand wastes. If we have one criticism to offer it is that the book is too condensed. There is certainly not a superfluous paragraph."—*Geographical Journal.*

Association of Managers of Sewage Disposal Works.

ANNUAL MEETING IN LONDON.

On Thursday, the 7th inst., the fifteenth annual meeting of the members of the Association of Managers of Sewage Disposal Works was held at the Holborn Restaurant, London, Lieut.-Colonel Jones, V.C., presiding, in the unavoidable absence of Dr. Sidney Barwise, M.D., B.Sc., president-elect. There was a good attendance, among those present being Dr. S. Rideal, Dr. Eric Rideal, Messrs. S. W. Lowcock, H. C. H. Shenton, F. J. Silcock and W. C. Easdale (Westminster), T. Hughes (Hampton), J. Crane (Romford), W. G. Smith (Heston-Isleworth), W. T. Money (Hanwell), W. H. Duckworth (Saltford), H. A. Roscoe (Westminster), E. Lindon (Wanstead), P. Lamb (Worcester), L. Hobgate (Grays), J. Edmonson (Southall-Norwood), J. Custance (Erith), J. T. Hall (Staines), A. Eade (St. Albans), H. Smith (Cambridge), S. Duxbury (Malden), J. H. Blizard C. W. Rothwell, G. P. Williams, E. E. Slater, W. J. Ellis, G. Quick (Brentwood), S. Terry, C. Terry (Canterbury), H. Edwards (Withington), W. J. Ashley (Oldbury), J. H. Barford (Maidenhead), C. A. Snook (Surbiton), J. Clifford Nuneaton), C. H. Ball (Manchester), A. V. Reynold (Longton), Edward Stamp (Ashton-under-Lyne), B. Giles (Burton-on-Trent), J. Bolton (Bury), W. L. Strachan (Aldershot), and Mr. J. B. Croll (Richmond), the hon. secretary.

ANNUAL REPORT.

The annual report of the council, which was read by the hon. secretary, stated that the war, necessarily, had interfered with the usual activities of the association, but while the work had been carried on with increasing difficulty, the association was in a sound and thriving condition, having lost nothing in numbers. The membership totalled 260, a nett increase of three. Owing to the increased price of paper, printing, &c., and relinquishing of subscriptions of members on active service, the income did not show the usual balance. The library had been added to, however, at considerable cost, its value having been enhanced. Although the usual meetings had been reduced in number, the attendances had been good, the proceedings being of an interesting and instructive character. The annual conference at Sheffield was particularly successful, special thanks being due to Mr. John Haworth. The report concluded: "It having come to the knowledge of the council that the War Office were constructing a number of sewage works in connection with the military camps in various parts of the country, directions were given that a communication should be forwarded offering the services of the council in the selection of qualified men capable of managing such works, and a letter was accordingly sent to the Chief Sanitary Adviser to the War Office, who, in a courteous reply, thanked the council and accepted the offer, with the result that they have been called upon to fulfil their obligations on three occasions, on two of which members of the association have been appointed, the third having failed on account of those selected being unable to come to terms." Members open to such appointments were invited to communicate in confidence with the hon. secretary. The council thanked both officers and members for the way in which they had carried on work in face of unusual difficulties, which were not likely to be less in the immediate future. Most of them had had to undertake increased work and additional responsibility, owing to depletion of staffs and voluntary work of national importance; but, happily, a healthy interest in the affairs of the association was maintained. The list was given of the members on active service.

Mr. J. H. Barford, in moving the adoption of the report, said the position of the association was shown to be most satisfactory, and it was gratifying to know that the members had willingly taken their part in national service.

Mr. A. V. Reynold seconded, and the adoption of the report was agreed to.

CHAIRMAN'S ADDRESS.

The CHAIRMAN, in the course of a short address, remarked that some of the members were old enough to remember the trend of public opinion during the 'seventies of last century, when the utilisation of sewage was generally associated with its purification. He believed that some of the younger members would live to see a great revival of the old belief that vegetable life thrived on dead organic matter, such as town sewage, applied to the soil as manure, and at the same time, that vegetation aided nitrifying microbes in purifying the sewage and neutralising everything noxious to animal life. There were now few survivors of the band of thinkers and workers like Sir Edwin Chadwick, Sir Robert Rawlinson, and their disciples, who sought to put that theory into practice for every town, but their work remained, and even now the theory was not disputed. The war had turned men's minds to every means of destroying the ranks of an enemy, and he was glad to think that Dr. Rideal hoped to produce explosives at sewage works. But one of the lessons of the war was the need of increased home production of foodstuffs, and there was a popular cry for the cultivation of waste land. There appeared, however, to be general forgetfulness of the fact that manure would be required if cultivation was to succeed. Knowing that the bulk of crop per acre on properly sewaged land could be three times as large as the average crop upon ordinary farms, the loss incurred by the waste of sewage, with all the cost of artificial treatment now commonly adopted for its defecation, was to be regretted. Young people might look for much social progress as a consequence of the work and movement of both sexes during the war when peace returned. Among the changes, local authorities responsible for sewage, water, gas, &c., must surely be allowed to purchase land for such purposes at fair market prices, and legal charges of transfer without uncertain litigation and expense of acquiring land by compulsion under present laws. The uncertainty made it quite impossible for an engineer to present a reliable estimate of cost, and authorities were reluctant to embark on a scheme with such estimates. To these and other causes he attributed the preference for artificial treatment requiring little land. But a more democratic Government would consider how much more meat, corn, milk and other foodstuffs might be raised in the country if the natural system of sewage treatment prevailed. The introduction of sugar manufacture into England was another thing brought into prominence by the war. A sugar factory would only pay on a large scale and if the sugar beet were grown within reasonable distance. These conditions were difficult to obtain with the four-course system of agriculture, but easy in sewage farming, where beet could be grown year by year on the same ground.

Dr. RIDEAL, before reading his paper, entitled

CAN EXPLOSIVES BE MANUFACTURED ON SEWAGE WORKS?*

remarked that perhaps his subject was rather one for the engineer than the chemist, but the more he looked into it the more he thought there was in it. Incidentally he mentioned the recovery of grease from sewage at Hamburg, which seemed to show there was an attempt on the part of the enemy to utilise sewage waste products.

Mr. EDWARD STAMP, chairman of council, took the chair at this point.

Mr. J. EDMONSON (Southall-Norwood) proposed a hearty vote of thanks to Dr. Rideal for his paper, which he thought showed the need for the Ministry of Munitions to form yet another department for the utilisation of waste products. If so, one would not see casein, which contained 16 per cent of nitrogen, being used in a composition for whitening street kerbs. He thought the last paragraph as to extraction of fat rather discouraging, but having a sewage with 10 per cent of free fat when dry, he believed by such extraction they would be assisting in the manufacture of explosives.

Mr. E. J. SILCOCK (Westminster), seconding, said that if Dr. Rideal's suggestions could be practically adopted there would be no need to import fats and nitrates. The waste of fat in camps should be dealt with. While he did not feel able to criticise the paper in detail, there were some practical considerations which he thought had escaped the lecturer. One was the question of the cost of a recovery pro-

See page 568.

ness and a consumption of fuel not least to be resolved at once. There was also the cost of the presstic of air. How to apply crude sewage at such a rate as to prevent effluent wasted involve necessarily greatly increased filter-beds. The evaporation of 10 ft was disputed, for it meant that the same evaporation must take place inside the sewage as well as on the surface. There were periods in the year when there would be no evaporation at all. The statements in the paper in this respect therefore appeared to be somewhat wide of the mark, but at the same time the facts put forward deserved careful study, for in these days we could afford to throw away no waste product capable of being economically utilised.

Mr. J. CLEMENT (Erith) pointed out that, while the question was largely one for engineers, it had an important chemical side. He had always felt that the purification of sewage depended more on engineers, but at the same time they must have a chemist at their side to help them. He did not think Mr. Silcock was really hostile to the paper, which admittedly contained matter which should set them thinking. Their thanks were due to Dr. Rideal, but obviously his suggestions if put into practice, would compel local authorities to incur very great expense. Even to-day some of them were unable to carry out the works necessary for their partnered populations. But he took it where there was a valuable sludge financial help would be forthcoming to enable the sewage works to put it to the best advantage.

Mr. S. B. LOWCOCK (Westminster) said that at one engineering point he agreed with Dr. Rideal, viz., that the volume of sewage should be given per head of population rather than in gallons. The latter method was apt to be misleading, and it was difficult by it to form any useful comparisons. The paper was generally suggestive. The trouble at all sewage works was known to every one present, and if they could get rid of it at reasonable cost the advantage would be great. If, in addition, they could do anything to assist in the production of munitions, they would be doing a great thing for the country generally. Dr. Rideal said, in a light and airy way, that the matter was one for engineers; speaking personally, he should hesitate a good deal before advising any local authority to experiment on the lines of the suggestions put before them unless he had got strong financial backing. But he would be delighted to be associated with any chemist in making the experiment and see what could be done, because, after all, he did think there was something in it.

Dr. ERNEST RIDEAL said he feared he could not contribute anything very illuminating on his father's paper. The nitrogen problem was an important one, not only for the present, but also for the future. It was absolutely scandalous that we should have to depend on South America, and he urged that members should give serious consideration to the various suggestions which had been put forward. Nitrogen could be got from the air as in Germany, but there was also the question of putting all our waste products to better advantage than was done at present. The products of sewage works were by no means the least important of the by-products which we had at our disposal in this country. The small land area prevented us dealing with evaporation in filter-beds. The removal of ammonia or activation had been shown to be a commercial proposition. Anyhow, the whole subject was of the first importance, and in view of the circumstances of the time no scheme should be lightly cast aside without proper examination. The ammonia question was being practically tackled in the United States. The addition of a little alkali was a cheap process, but all these problems had yet to be worked out. After the war all European countries would be practically in the same boat, though it was possible that we should be in a more favoured position than any other nation in Europe. Competition would be very keen, and we had need to utilise all the services that engineers and chemists could give us in using every by-product we had.

Mr. H. C. H. SHENTON (Westminster) pointed out that the cost of carriage of nitrates should be set against the expense of procuring them by other means. In fact, we ought to be prepared to pay any price for them. He thought that the money would be available for carrying out some of Dr. Rideal's suggestions, which were all worth thinking out. The expense to him seemed to be a minor consideration.

The motion having been agreed to,

Dr. RIDEAL briefly replied, and thanked the members for the reception of his paper. He could best answer the criticisms of his paper by calling attention to the two last paragraphs in his paper which he had not read. He had suggested several directions in which Government help to sewage works would not be money spent in vain.

A paper, entitled "Modern Sewage Works Their Design, Construction, and Management," was afterwards read by Mr. C. TERRY (Canterbury), a short discussion following.

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is not the London Water Board to be congratulated upon at last taking the advice of that eminent scientist Dr. Houston, in sterilising by the hypochlorite process the water supplied to London? Is it not evident that this process will save the construction of further gigantic reservoirs, the cost of further pumping, and solve the difficulties which have hitherto occurred in connection with the danger of supplying water when the Thames was in flood? Could not their example be usefully followed by other water authorities?

* * *

In connection with the problem of securing increased safety to pedestrians, would it not tend to help matters in this direction if local authorities would place many more refuges in the carriage ways? Could not these at some points be constructed cheaply of wood, securely fastened to the existing pavement, and be removed when normal times recur?

* * *

Is it not to be hoped that the new Government will see their way to formulate some plan by which the services of interned Germans and German war prisoners may be utilised on our roads, or in some other manner, to replace the men who are fighting for our lives and liberty at the Front? Could not special constables, volunteers, or even convalescent wounded soldiers be used to guard these men while they were at work?

* * *

Can we not reasonably hope, with a man of the scientific attainments of Dr. H. A. L. Fisher as the new President of the Board of Education, that science and physical research will at last come to their own in our educational curriculum? Will not the effete and monastic teaching which flourished during the Middle Ages, and even into most of the last century, now be scrapped in favour of a sounder system of imparting information in our schools and colleges?

* * *

Is it not about time that this country should wake up to the fact that a food shortage is not only possible, but probable, during the year 1917, and that unless something is done to increase the supply upon our own "little island" very serious consequences may result? Was not the article in THE SURVEYOR of December 8th by Mr. Jubb, clerk to the urban district council of Bognor, well worthy of our attention, and is it not devoutly to be hoped that other local authorities will follow the example of Bognor? Is there not a well-known saying that a man is a great man who can make two blades of grass grow where one grew before, and should we not paraphrase that by saying he would be a greater man if he could make potatoes grow where grass grew before?

* * * *

Was not the report of the superintendent of the cleansing department of the Bradford Corporation, given in THE SURVEYOR of November 24th, very interesting reading? But would it not appear that the ashpits and dustbins were not emptied sufficiently often when we read that the average number of times each ashpit, &c., was emptied during the year was only 17·54, which is about a three weeks' service? Does not the cost also appear to be rather high when we find that the nett cost per ton for removal and disposal amounted to nearly 8s. 1d., and this with such an infrequent removal of the refuse?

* * * *

Was it not rather interesting to read that a conscientious objector at Chesterfield who was sent to act as a stoker at the local refuse destructor, "developed a still more conscientious objection to that class of work and promptly joined the Army"? Are the "objections" of these conscientious objectors only skin-deep?

CORRESPONDENCE.

Εἷς ἀνὴρ οὐ πάνθ' ὁρᾷ

(One man does not see everything.)
—Euripides.

CONCRETE ROADS.

To the Editor of The Surveyor.

Sir,—In reply to your correspondents, Mr. Boulnois and Mr. Jones, I beg to say that the concrete road referred to was laid on a substantial hand-set bottom, 9 in. deep, on which was laid 4 in. of concrete 6 to 1, and thereafter a finishing coat 2 in. thick of 2 to 1 granite chips and cement. The traffic was kept off for a fortnight. All the materials were carefully selected and the cement tested. It is perhaps a little misleading to use the word "corrugations" in connection with the wear of the surface, as this implies a certain amount of regularity which did not exist. The surface simply gave way by wearing into potholes, much in the same way as an ordinary macadam road, and the wear over the whole surface in the line of traffic is clearly seen, as the manhole covers, &c., stand at the original level. Once the surface gives way the depressions rapidly increase in size. As the roadway is of fair width, a strip of about 5 ft. on each side adjoining the kerbs is subjected to very little traffic, and the surface of these strips is practically as good to-day as when laid, thus showing, I think, that the failure of the concrete in the centre of the road is entirely due to the action of the traffic.

It is usual to lay concrete roads in alternate bays or panels, say, 10 ft. in width, but, as the joint of each panel leaves a weak spot in the road where failure is sure to be first observed, an endeavour was made in some instances to get over this by putting down the finishing coat in a continuous carpet, so that an area of nearly 400 sq. yds. was laid without any joint, and no defects due to expansion or contraction can be seen.

Concrete roads have been in use in this district for over thirty years. These were first laid with 6 to 1 concrete, having 2-in. metal as aggregate, and no finishing coat. These are still in existence and in fair order, and very little has been spent for repairs, as the traffic is very light. About twelve years ago the method of putting on a finishing coat of fine concrete was adopted, and streets laid in this manner retain an excellent surface where the traffic is light. In resurfacing, I have found that the finishing coat can only be removed by hacking off with a quarry pick, which is a somewhat slow and expensive process.

In reply to Mr. Boulnois, I beg to say that, in my opinion, a well-laid concrete road would have a longer life than a tar-macadam road, assuming that neither had to be cut up nor repaired in any way. If many openings have to be made, however, the expense, inconvenience and deterioration in the case of the concrete road would be greater. For these reasons I am now reverting to tar-macadam in streets where traffic is light and sett paving where traffic is heavy.

Few corporations are in the happy position of having the power to carry out all reinstatements of road surfaces where broken up by gas, water and other authorities, or private individuals, and I am afraid the day is far distant when they will be vested with such powers. None of our concrete streets are tar-sprayed. I have been as enthusiastic about concrete roads as anyone, but, after lengthy experience, I have come to the conclusion that this will not become a popular method of paving until the difficulty and slowness of repairs can be overcome, and I have not yet discovered a method of laying it so as to stand heavy traffic.—Yours, &c.,

Concretor.

December 18, 1916.

SURVEYORS AND MILITARY SERVICE.

To the Editor of The Surveyor.

Sir,—With reference to the letter from "A Constant Reader" which appears in your current issue, I venture to suggest that there is a complete misunderstanding as to the application for commissions for road construction in France.

The original letter from the engineer and manager of the Road Board, Brigadier-General H. P. Maybury, contained the following as its first request in the matter:—

"A large number of engineers and surveyors are already serving with the Colours, and if information relating to these gentlemen could be furnished to me, an endeavour would be made to secure them for work for which, by their training and experience, they are peculiarly fitted. The same remarks apply to foremen and men, and information is requested at once, showing—

"(*a*) In the case of officers, their rank and the unit to which they are attached; and

"(*b*) in the case of non-commissioned officers and men, their full names, regimental numbers, units to which they are attached or belong, and rank, if any.

"With this information should be forwarded a statement showing the particular duties performed by each individual in civil life."

I know that other borough engineers as well as myself took this to mean *exactly what it said*, and in sending up our lists of men available for this road work we included the names of members of our staffs who already were officers in the Army, as well as others already in the Army who were suitable for subaltern commissions, and this will account for the very large number who are stated to be applicants for commissions. Four out of ten of those whose names I sent up already have commissions in the Army, and in each case I sent in their names without their knowledge and without knowing whether they would prefer to carry on in their present position, or whether they would prefer to be transferred to road work, as suggested in Mr. Maybury's letter.—Yours, &c.

H. Gilbert Whyatt, M.Inst.C.E.,
Borough Engineer and Surveyor, Grimsby.

December 18, 1916.

LOCAL AUTHORITIES AND DEFENCE REGULATIONS.

DISTRICT COUNCIL FINED.

An unusual prosecution under the Defence of the Realm Regulations was heard at Warrington on Wednesday (the *Liverpool Post* reports), when the Newton-in-Makerfield Urban District Council was summoned for failing to have a responsible person constantly in attendance at their gasworks to receive air-raid messages.

It was stated that on the night of November 27th the telephone operator at the Newton Exchange rang up the gasworks at Earlestown at four minutes past eleven, but received no reply. The operator rang up several times later, but no answer was given until twenty minutes later. In the meantime the operator telephoned to the police station, and special constables were sent to the works.

Mr. E. A. White, who appeared for the council, contended that under the regulations the police could not succeed, as the section only dealt with the obscuring of lights. He pointed out that the telephone in the office was connected with a fire bell and also a bell in the boiler-house, but by some misunderstood order these bells were disconnected by the post office authority on the date in question, otherwise the alarm would have been received.

A fine of £10 was imposed.

Chatham Municipal Coal Depot.—The borough surveyor of Chatham, Mr. C. Day, reports that the municipal coal depot in that town, which has been established less than a month, has already sold more than 83 tons of coal, the majority of the purchases being of 14 lb. and 28 lb. The total number of purchases has been 6,079, and the money taken, amounting to £166, leaves a small surplus after payment of the expenses of the depot and of loading and carting.

Tarvia Greetings.—Always enterprising, Messrs. Bristowe & Co., Limited, send to their friends a very clever pictorial expression of good wishes for Christmas, 1916. It is by F. H. Townsend, whom we take to be the well-known art editor of *Punch*, and one of our most famous artists in black-and-white, and it depicts the interior of a laboratory, showing Mr. Bristowe and Mr. Vernon Parker at work at a huge cauldron of Tarvia, the latter coatless, but adorned with a waistcoat that would have been the envy of Sam Weller. Road engineers have universally admitted the value of Tarvia, but they will be surprised to gather from this Christmas card that its composition includes such costly ingredients as gold dust and radium. Mr. Bristowe is probably too much absorbed in his work to notice that Mr. Parker is "featured," as no doubt the artist saw him, puffing away at the inevitable cigar of generous size, in spite of the notice on the laboratory door that smoking is forbidden.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Batley T.C.—The borough surveyor, Mr. O. J. Kirby, has received instructions to prepare a sketch-plan for a disinfecting and contact station.

Beckenham U.D.C.—In the case of a motor shed that had been erected in contravention of the by-laws, and no plans deposited, the surveyor, Mr. J. Angell, was instructed to inform the owner that the shed must be covered either with corrugated iron or by asbestos, when an annual licence would be issued. With respect to some flats that had not been constructed according to the by-laws, and had been occupied prior to the issue of a certificate of completion, it was decided to take legal proceedings against the offenders.

Coventry T.C.—A conference is to be convened of representatives of the Board of Education and the Higher School Sub-Committee with respect to the provision of additional schools.

Newbury T.C.—It is proposed to provide a smallpox hospital, at an estimated cost of £110.

Newton Abbot U.D.C. The Sanitary Committee reported that the inspector had been instructed to obtain particulars with regard to the provision of a temporary public slaughter-house.

Middlesex C.C.—The council have accepted the tender of Mr. H. Moorcroft, Acton, at £521 for repairs to Hayes county bridge.

Stokesley R.D.C.—The surveyor, Mr. W. H. Dixon, has been instructed to prepare a plan for the widening of Bartle Bridge, Great Ayton.

Worthing T.C.—A special committee has been appointed to take into consideration and report upon a suggestion to provide a winter pavilion.

HOUSING AND TOWN PLANNING.

Glasgow T.C. A special committee have approved of a report by Bailie Drummond and Sir John Lindsay (town clerk) on the subject of housing accommodation in the city. The committee recommend that the corporation should adopt the report and ask the committee to select a site or sites for the erection of dwelling-houses and to prepare plans of houses, the erection to be proceeded with as may be decided by the corporation.

Guildford T.C.—A scheme has been approved for the erection of twelve cottages after the war.

Leith T.C.—The Public Health Committee have been authorised to inquire into the housing needs of the burgh, and, if deemed advisable, formulate a scheme to provide houses.

Milnrow U.D.C.—A sub-committee has been authorised to prepare a housing and town planning scheme.

Sheffield T.C.—The Local Government Board have decided to comply with applications of the city council for authority to prepare town planning schemes in respect of certain lands situate at Stumperlow, Fulwood, and Whirlow (known as Area No. 4), and Banner Cross, Brincliffe, and Kenwood Park (known as Area No. 5).

MOTOR TRANSPORT.

Barnsley T.C.—The purchase of a new motor fire engine is being considered.

Bolton T.C—A sub-committee has been asked to consider upon the adoption of motor traction for departmental work.

Bristol T.C.—It has been agreed to purchase another 4-ton steam lorry for the removal of house refuse, as well as a steam lorry for general work.

Cuckfield R.D.C.—The council have accepted the tender of Mr. Hampton, at £199, for a motor ambulance for use in connection with the isolation hospital.

Darlington T.C.—The Streets Committee have been authorised to place an order for a motor wagon for haulage purposes.

Lancaster T.C.—It was intimated on Wednesday that the Local Government Board had sanctioned an outlay of £3,600 on new motor 'buses, the loan to be repaid in six years.

Sheffield T.C.—Authority has been given to transfer certain motor lorries to the military authorities on the understanding that priority certificates would be given for others to replace them.

Walthamstow U.D.C.—It has been decided to purchase a motor lawn mower.

PARKS AND OPEN SPACES.

Whitley and Monkseaton U.D.C.—It has been agreed to pay a deposit for the proposed purchase after the war of a site opposite the Monkseaton railway station, for the purpose of an open space.

REFUSE COLLECTION AND DISPOSAL.

Beckenham U.D.C.—The question of dealing with the collection of waste paper has been referred to the Works Committee.

Worthing T.C.—The Sanitary Committee reported that, as the result of one collection of waste paper, 5 tons of newspapers and 1½ tons of books had been obtained, and the receipts from the sales had been £33 3s. 8d. A baling machine had been purchased for £16 14s. 3d., and it was proposed to continue the collections.

ROADS AND MATERIALS.

Andover R.D.C.—A tar-spraying equipment is to be purchased at an estimated cost of £130.

Blackburn T.C.—The Cleansing Sub-Committee reported to the full committee on the question of the re-organisation of the street-sweeping department. Having considered a statement by the borough engineer, Mr. Arthur Race, on the question, the sub-committee recommended that the matter be deferred for the present owing to the difficulties of obtaining plant and labour through circumstances arising out of the war.

Broadstairs U.D.C.—Tenders for tar had been invited from the Broadstairs Gas Company and the gas and water department of the Ramsgate Corporation. The secretary of the former wrote regretting inability to tender, but the manager of the latter offered 22,000 gallons, to be delivered during a period of one year, at 3¼d. per gallon, and the tender was accepted.

Cardiff T.C.—The Property and Markets Committee recommend the Works Committee to proceed with the kerbing of the pavements in Cathays Park.

Carlisle R.D.C.—The council have consented to ten of their men volunteering for road work in France, and have agreed to place at the disposal of the military authorities any plant available.

Carmarthenshire C.C.—The Main Roads Committee have concurred in the proposal of the Kent County Council for the employment of German prisoners on county highways.

Dublin C.C.—The council have approved the scheme of the county surveyor for the execution of works on the river bank at Barnageeragh, at an estimated cost of £750.

Hythe T.C.—Road improvements are to be executed to the Ladies'-walk, Canal-bank, and The Grove, at an estimated cost of £110.

Lewisham B.C.—Estimates are being obtained of the cost of a number of proposed wood-paving schemes.

Newhaven R.D.C.—The surveyor, Mr. Arthur C. Groves, reported that the engineer of the Road Board and himself had visited the road from Newhaven to Seaford, and the engineer recommended that the sides be raised 2 in. or 3 in. They had also visited the by-roads Denton to Poverty Bottom and other roads in the district, and the engineer suggested they be seen to at once, and approved the cost of making them up.

Norfolk C.C.—The chairman of the Eastern Highways Committee, Mr. R. J. Colman, stated that the committee had seen a model of a new snow plough prepared by the county surveyor, and that some weeks ago Mr. Gladwell asked his sanction to have some of the ironwork for new ploughs made, as the old

ploughs were decrepit and worn out. He took upon himself to order eight, and the Western Committee had also ordered some. These new ploughs were collapsible, and could be stored away in the summer under cover, which the present unwieldy ploughs could not be. It struck him as being an improvement which was wanted. The county surveyor said he really wanted twenty new ploughs; the approximate cost was £9 10s. each. The committee consented to the purchase of the number asked for.—The county surveyor reported that four of the council's district surveyors and 140 roadmen had joined the Colours; two men had been discharged, four were missing, and he regretted to state that eleven had been killed. It was proposed to transfer the surveyors and also men who were now serving from the units to which they were attached to the new service on the roads in France. There were at the present time seventy-eight men under fifty years of age employed on the council's roads, thirty three had volunteered, and seven district surveyors had also offered their services. The following plant belonging to the council had been offered: Fourteen hand-scraping machines, eight horse-scraping machines, two sludge carts, two horse sweepers, and seven steam roller sleeping vans. It was reported that the county surveyor had volunteered for the road service in France, but the Eastern Highways Committee resolved to take the same line as the Western Highways Committee in intimating to the military authorities that they could not spare Mr. Gladwell.

Sheerness U.D.C. The question of the immediate repair of certain streets is being considered by the Works Committee. The work is part of a scheme of works which the surveyor, Mr. T. F. Berry, estimates will cost £927.

Westhampnett R.D.C. In regard to the motor 'bus service between Chichester and Midhurst and Chichester and Bognor, the Aldershot and District Traction Company wrote that they could not see their way at present to pay anything further towards the upkeep of the highways, and the Southdown Motor Services stated that the payment of 3d. per 'bus-mile was quite prohibitive, and that in the circumstances the company had decided to withdraw the service entirely. It was reported that the road material undelivered to date was approximately 5,000 cub. yds. Having regard to the difficulties of contractors in obtaining the necessary labour to enable them to complete their contracts, the council resolved that no steps be taken to enforce delivery, and that the general repair of road sections for which no material could be obtained be limited to emergency work. The clerk conveyed representations from the surveyors on the damage to the roads caused by the drawing of road material on wet days by haulage engines, the contractor on fine days being engaged in threshing operations. It was urged that the use of engines on wet days for this purpose should be discontinued and that horses and carts should be utilised instead. The council resolved to ask the contractor to make use of horses and carts for the conveyance of stone.

SEWERAGE AND SEWAGE DISPOSAL.

Bexley U.D.C. The surveyor, Mr. W. T. Howes, estimates the cost of providing a surface-water sewer from near the Upland Schools, *viâ* Church road, Princess-street, West street, to the existing surface-water sewer in the Broadway, at £355. It is not proposed to do the work till after the war.

Camberwell B.C.—The borough engineer, Mr. W. Oxtoby, has submitted his report on the annual contracts, and the Public Health Committee state, with regard to stoneware drain pipes and bends, that the existing arrangement with the Addington Timber, Slate and Cement Company, Limited, is that they shall supply these articles at 17½ per cent below standard price list current, and 2½ per cent at settlement. It was understood that these contractors were prepared to continue the supply of the necessary drain pipes, subject to a variation of 10 per cent below standard price list current, and 2½ per cent at settlement. The committee stated that they are prepared to agree to this variation, and with regard to the other requirements have left the matter to the borough engineer to obtain prices as required.

Hulme Cultram U.D.C.—A letter has been received from the Local Government Board declining to sanction a proposed loan for outfall works on the Silloth sewer. The Silloth Committee intend to press the matter, and have forwarded a copy of the medical officer's report to the Local Government Board.

Wolverhampton T.C.—The profit from the sewage farm for the year ended last March was £2,588, the income of £2,796 from the sale of milk.

WATER, GAS, AND ELECTRICITY.

Blackburn T.C.—An intimation has been received from the Treasury through the Local Government Board that they are not prepared to sanction the proposed loan of £74,568 for the extension and improvement of the Greenbank gasworks, except as regards the amount required for the provision of tar-distillation plant, for which a loan for £5,000 would be sanctioned.

Brigg R.D.C.—A firm which applied for a supply of water for a number of houses, and also to works where some hundreds are employed, has been asked to bear half the cost of laying the mains, estimated at £600.

Brighton T.C.—The offer of Messrs. Ashwell & Nesbitt, Limited, to purchase a third 440-kw. Willans-E.C.C. generator on behalf of the Ministry of Munitions, for the sum of £1,250, has been accepted by the Lighting Committee. The engineer and manager reports: "This is the same price as we received for the other two sets which we have already sold them, they to dismantle, pay carriage, and re-erect at their own expense. This set is known as No. 11, and was purchased in 1897 for the sum of £4,788." The set being most urgently wanted, the committee, at their meeting on December 12th, gave permission for the removal of the plant forthwith.

Buxton U.D.C.—The Local Government Board have written intimating their sanction to a proposal for the installation of additional plant at the gasworks.

Dover T.C.—The town council propose to take up a loan of £3,884 for laying a new electricity cable to East Cliff.

Dunfermline T.C. The town council have accepted the tender of Mr. James Ritchie, Dunfermline, at £28,746, for laying a water main from Craigluscar to Rosyth, a distance of 6 miles. The pipe will vary in diameter from 9 in. to 20 in.

Greenock T.C.—It is proposed to incur an expenditure of £6,000 on extensions at the gasworks.

Hammersmith B.C.—An extension of the electricity mains in the Starch Green district is proposed, at an estimated cost of £683.

Hinckley U.D.C.—The Gas Committee have received authority to purchase sixteen new gas retorts.

Macroom U.D.C.—In the matter of the dispute between the council and the contractors of the waterworks, Messrs. Fleming Bros., Portrush, the arbitrator, Mr. Francis Bergen, has found that the council should pay a sum of £1,045 to the contractors, and the cost of the arbitration. The contractors' original claim in connection with the contract was £1,400. The council's engineer had certified £960 as being due to them, but from this it was proposed to deduct the wages paid to the clerk of works and engineer during the period of overtime.

Newport (Mon.) T.C.—The Waterworks Committee have been authorised to view a proposed site for an additional water supply.

Rawmarsh U.D.C.—A loan of £1,000 is to be taken up for the purpose of the gasworks.

Sunderland T.C.—The Electricity Committee advise an extension of the high tension mains, at an estimated cost of £225.

Swansea T.C.—The corporation reports that, owing to difficulty in getting servants for the hospital, electrical apparatus for cooking and heating is being installed to lessen housework.

Widnes T.C.—The town council recently adopted a recommendation of the Water Committee to increase the price of water for domestic purposes from 5¼ per cent to 6¼ per cent on the yearly value. The reason assigned was the increased cost of materials and labour.

MISCELLANEOUS.

Camberwell B.C.—The Public Service Committee recently arranged with the South Metropolitan Gas Company for the installation at the Old Kent-road baths of a forced-draught apparatus, which permits of the consumption of coke, and also does away to a great extent with the nuisance from smoke. This apparatus has proved very satisfactory, and has effected a saving in fuel. Having received a report from the borough engineer upon the subject, the committee have made arrangements for the provision

of a similar apparatus to two boilers with double furnaces at the Old Kent-road baths, and for five of these contrivances to be fixed to furnaces at the Queen's-road baths. The work of fixing will be carried out by the gas company, and the whole cost, including the contrivances themselves, will amount to about £79 4s. The Works and General Purposes Committee have arranged to allow the council's workmen the use of the paddock at Grove-vale depot for the growth of vegetables.

Southend T.C.—The bathing pool constructed on the Western Esplanade having proved a great attraction to visitors, sites have been arranged for others, which will not, however, be put in hand until the end of the war.

Twickenham U.D.C. The council are providing 300 plots for allotments under the Cultivation of Waste Lands Order.

LOCAL GOVERNMENT BOARD INQUIRIES.

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APPLICATIONS FOR LOANS.

Cork R.D.C. £1,000 for water supply extensions.

Heywood T.C. £1,155, supplemental loan for the sewage disposal works.

Radcliffe U.D.C. £930 for the provision of electricity for power purposes.

Ventnor U.D.C. £150 for the reconstruction of a groyne.

LOANS SANCTIONED.

Birmingham T.C. £7,530 for cooling towers and a pipe line.

Fulham B.C. £10,500 for boilers and foundations at the electricity generating station (repayable in fifteen years), and £500 for a temporary building (repayable in five years).

Lancaster T.C. £600 for new booster plant.

LOAN REFUSED.

Malvern U.D.C. £2,000 for electric cable extensions.

SURVEYORS AND MILITARY SERVICE.

A REJECTED OFFICIAL'S TRIALS.

At the last meeting of one of the Southern urban district councils the surveyor applied for permission to be released from his duties as surveyor and sanitary inspector, in order that he might fill an appointment under the Army authorities in connection with the building of huts. He gave as his reason that, although he had been totally rejected by a medical board for military service, to all appearances he was fit to serve, and that he was subject to criticism by the public, who were unaware of the facts of his rejection. He had been the subject of abusive anonymous postcards, and he felt his position acutely.

The clerk expressed his opinion strongly that the surveyor was very unwise to take notice of such criticisms as he had a perfectly clear conscience, inasmuch as he had done his best to get into the Army before his total rejection. He further pointed out that if he got the appointment he was seeking he would be among strangers and thus would be far more subject to criticism than he would in a place where he was known.

The matter was discussed at length. It was felt that the surveyor, even though fit for military service, would be justified in remaining in his present employment, inasmuch as his work was of distinct national importance and that he was invaluable to the council. It was unanimously decided to express to him the council's disapproval of his application to be released.

Edinburgh Tramways Conversion.—The Ministry of Munitions, it is understood, have given their decision in respect to the conversion of the Edinburgh car system from cable to electric or otherwise. Some time ago representations (says the *Glasgow Herald*) were made on the matter to the Ministry, and at the same time occasion was taken to ask the views of the authorities with regard to the prosecution of the work at Portobello electric power station, where work had been begun. In both cases the Ministry of Munitions has declined to allow the corporation to do anything until the end of the war.

PERSONAL.

Mr. Arthur Race, borough engineer of Blackburn, has been granted leave of absence for six months for health reasons.

Mr. W. O. Ord, chief assistant, water department, Croydon Corporation, has been elected a member of the Institution of Municipal and County Engineers.

Mr. J. W. Wilson, surveyor to the Bolton-on-Dearne Urban District Council, has been elected a member of the Institution of Municipal and County Engineers.

Mr. Felix Collins, pupil to Mr. J. R. Mead, borough surveyor of Ipswich, has been elected a student of the Institution of Municipal and County Engineers.

Mr. W. H. Ashbridge, who served his articles in the Wigton Rural District Council surveyor's department, has been appointed highway surveyor to the council, at a salary of £140 a year.

Captain Sidney E. Cowan, of the Royal Flying Corps, son of Mr. P. C. Cowan, D.SC., M.INST.C.E., chief engineering inspector to the Local Government Board of Ireland, has, we regret to state, been reported as missing. Before obtaining his commission in the Royal Flying Corps in August, 1915—on his eighteenth birthday—the missing officer was a member of the Officers' Training Corps in connection with Dublin University. He soon distinguished himself by his pluck and daring, and was honoured by the King on three occasions during the present year for

CAPTAIN S. E. COWAN.
["*Irish Builder and Engineer*" *Photo.*]

conspicuous gallantry and skill in attacking the enemy. On May 31st Captain Cowan was awarded the Military Cross for a deed of surpassing bravery in the enemy lines. He was personally decorated by His Majesty at Buckingham Palace in June. Returning to the Front, his dashing methods of attack secured for him a bar to the Military Cross. On November 14th he was granted a second bar for a deed thus described: "He fought a long contest with seven enemy machines, finally bringing one down in flames. He has displayed great skill and gallantry throughout." Altogether he accounted for five enemy aeroplanes. Writing on November 18th last, his Commanding Officer said: "During the whole of the time he has been with me he has always done very fine work. I have never come across a better or more plucky pilot than he was. He won the Military Cross three times, so that alone shows how he worked out here. He was always ready to do his work, no matter how much there was to be done. I do not know what we shall do without him; she was always so cheery that it did one good to be with him. All his brother officers are very sorry about him and offer their deepest sympathy." The

members of the engineering profession in Ireland, and others with whom his official duties brought him into contact, will feel sincere sympathy for Dr. Cowan and his family.

Mr. I. W. Kirsopp, highway surveyor to the Carlisle Rural District Council, was presented recently with a tea and coffee service by the members of the council as a marriage gift. Mr. Kirsopp has held office for nearly twenty years.

Mr. N. A. Loraine, J.P., the chairman, and Mr. H. C. Fread, the surveyor, of the Esher and the Dittons Urban District Council, have been appointed representatives on the council constituted in connection with the "Safety First" campaign in the Metropolitan Police area.

Mr. G. J. Holmes, borough surveyor of Okehampton, has been called up for service, and the council have resolved, subject to the approval of the Local Government Board (we learn from the *Western Morning News*), that Mr. W. J. Avery be appointed temporary surveyor, at a salary of 17s. 6d. per week.

Mr. R. H. Clements, deputy borough surveyor of Brighton, has submitted his name for a commission in the Royal Engineers for road service in France, and the Works Committee have resolved to grant him leave of absence, at the same time recommending that the War Allowances Sub-Committee should pay him such a sum as will bring his annual income up to 25 per cent in excess of his present salary of £350 a year. Mr. H. S. Wood has been appointed assistant borough surveyor during the absence of Mr. Clements.

The council of the Institution of Municipal and County Engineers at their last meeting resolved to nominate Mr. P. H. Palmer (Hastings) as president for the year 1917-18. It was also resolved to nominate Messrs. T. W. A. Hayward (Battersea), H. E. Stilgoe (Birmingham), and C. Brownridge (Birkenhead), as vice-presidents, and Sir James Lemon as hon. treasurer for the same period. The president-elect has occupied the position of borough surveyor and water engineer of Hastings since 1889, previous to which he was deputy borough engineer of Brighton. At Hastings he has carried out an entirely new water supply to the town, in addition to very extensive sea defence works, and has to a large extent reconstructed the main drainage. He is a member of the Institution of Civil Engineers, and a past-president of the Institution of Water Engineers.

OBITUARY.

Lieut. J. E. Shore, R.E., son of the late Mr. G. Eaton Shore, borough surveyor of Crewe (who died early in November), has, we regret to state, been killed in action. By a singular coincidence the son was killed at the same hour that his father died.

We regret to record the death of Mr. S. Stevens Hellyer, on December 8th, in his seventy-sixth year, at Berne, Switzerland. He was well-known as a pioneer of sanitary reform, and was for many years head of the firm of Messrs. Dent & Hellyer, sanitary engineers, of 35 Red Lion-square, W.C., but formerly of 21 Newcastle-street, Strand. The firm dates back to 1730, and was originally established in the Strand. "The Old Plumber's Shop near the Strand," the name by which it was familiarly known by the firm's numerous patrons and employees, has held a high reputation for many years in the plumbing and sanitary engineering world, and its world-wide fame is undoubtedly due to the skill, energy and enterprise of its late revered chief. Mr. Hellyer came to London many years ago from Devonshire, and entered the firm of Messrs. Beard & Dent, in whose business he soon took the leading position. During the year 1881, when modern methods were rapidly replacing the old obsolete insanitary arrangements, Mr. Hellyer delivered at the Society of Arts, for the National Health Society, a course of free lectures, in which he proved, with the aid of numerous large coloured diagrams and by practical demonstration, the advantages of new and improved methods of sanitation. The lectures were so well received that they were repeated at a later date, and were subsequently published in book form. He was the first examiner in plumbers' work for the City and Guilds of London Institute, and afterwards became consultative examiner. Mr. Hellyer wrote a book, which was much appreciated, entitled "The Plumber and Sanitary Houses." It ran through several editions, and was regarded as the most complete work of the kind on modern plumbing and general sanitation. Then followed a students' book on "Principles and Practice of Plumbing," which became very popular among the younger members of the trade, and was accepted as a standard text-book in the technology of plumbing. Those who were intimately associated with him will always cherish his memory, and regard him as a true friend and generous employer.

FOR OTHER ADVERTISEMENTS
See End of Paper.

SAINT PANCRAS BOROUGH COUNCIL.

The Highways, Sewers and Public Works Committee invite Tenders from persons willing to execute Contracts for the Work or Materials below described for one year, commencing 1st April, 1917.

Tenders, under endorsed covers (supplied), to be delivered at the Office of the Department of Works at the Town Hall, Pancras-road, N.W., not later than 12 o'clock noon on Monday, the 8th January, 1917.

1. Removal of Road Sweepings and Gully Soil.
2. Horsing Water Vans.
3. Horsing Road Sweeping and other Machines.
4. Cartage.
5. Timber and Joinery Materials.
6. Barrows, Trucks, Handles, &c.
7. Paints.
8. Oils.
9. Candles and other Chandlery.
10. Smiths' and Founders' Works.
11. General Ironmongery.
12. Tools and other Hardware Goods.
13. Yorkshire Stone and Artificial Paving Slabs.
14. Granite Kerbs, Paving Setts, Broken Granite and Kentish Rag.
15. Gravel and other Roadway Materials.
16. Sundry Materials (Lime, Cement, Bricks, Stoneware Pipes, and other Glazed Goods).
17. Bass Brooms and Horse Brush Stocks.
18. Tarpaulins, Hemp and Rubber Goods.
19. Pitch, Tar, Creosote Oil, Carbolic Powder, and Coke.

No Tender will be considered unless made out on one of the printed Forms, without any alteration thereof, which, with any further particulars, can be obtained on application to Mr. Wm. Nisbet Blair, M.INST.C.E., Borough Engineer and Surveyor, up to the morning of the said Monday, the 8th January, 1917.

The Council do not bind themselves to accept the lowest or any Tender.

Intending Contractors are not required to attend the Committee.

(By order)
C. H. F. BARRETT,
Town Clerk.

Town Hall,
Pancras-road, N.W.
December 20, 1916. (3,209)

HERTFORDSHIRE COUNTY COUNCIL.
TENDERS FOR GRANITE, SLAG, AND TAR-MACADAM.

Tenders are invited for the Supply of Broken Granite, Slag, and Tar-macadam required for the Main Roads during the year ending March 31st, 1918.

Forms of Tender and Conditions of Contract may be obtained on application at my office, or will be sent through the post upon receipt of a stamped addressed foolscap envelope (2½d.).

Tenders, which must be upon the forms provided, are to be delivered not later than January 13th, 1917.

The lowest or any Tender will not necessarily be accepted.

J. S. KILLICK,
County Surveyor.

County Surveyor's Office,
Hatfield.
December 20, 1916. (3,210)

BOROUGH OF CHEPPING WYCOMBE.

The Corporation is open to receive Tenders for the Supply of Stoneware Pipes for the forthcoming year.

Form of Tender can be obtained at the Office of the undersigned, to whom all Tenders must be delivered by not later than 3rd January, 1917.

T. J. RUSHBROOKE,
Borough Surveyor.

25 Easton-street,
High Wycombe,
December 20, 1916. (3,208)

OPEN SPACES.

By Prof. S. D. Adshead.

[From fifth of series of lectures on the Town Planning of Greater London After the War.]

In my first and second lectures I went somewhat fully into the factors controlling development, and showed that the most important of these was the provision of easy communication by train with the centre of London. Diagrams of suburban railway systems, both steam and electric, are conclusive in proving that railway lines, and not roads, exert to-day the greatest influence on the development of suburbs. Main roads are necessary, and very necessary, when a later stage in development has been reached; but there are important and flourishing suburbs around London to which no main road approaches. So that, having regard to the future development of open country around London, it is the progress of the railways that we ought most closely to watch.

A reference to a general map of Greater London, which outlines those areas that are to-day contiguous to good lines of communication, shows us that many unexploited green strips still penetrate to within 4 or 5 miles of the centre of London. These rural oases await with concern the exploitations of the railway director, and it is an important question as to how, if at all, the future development of such areas should be controlled.

RURAL AREAS AROUND LARGE TOWNS.

Many propositions have been advanced as to how the rural areas around large towns should be dealt with. There are those who hold that no town should extend beyond certain limits; that at a given period in its growth an agricultural or arable belt of open country should be left, and that further development should only take place outside that belt. Then there are those who advocate leaving open radial spaces between lines of development, widening as they extend out. Having regard to the general tendency for all development to extend out along radial lines, the latter proposition would seem the most natural. But is it reasonable to limit development in so drastic and artificial a way? Is it not possible to control development by limiting it in a more natural way? Is it not possible to have suburbs that are rural retreats and not town extensions?

As well as the suburbs that lie on the fringe of urban London, cannot we have modern, up-to-date suburban towns and modern, up-to-date suburban villages, with an assurance that they will never be surrounded and chocked. The solution of the problem of how to deal with these extensive agricultural areas that encroach on London, and that as yet have not been exploited by railways, seems to me to be to provide within them selected areas for building developments, and limit them in size, leaving a surround of agricultural land. . . .

In suggesting that these undeveloped lands that to-day penetrate into Greater London have restrictions placed upon them which admit of limited areas of development and sites for small groups of houses, which I have described as villages, it must not be supposed that, in thinking of such places, I have in my mind the immortal village of Gray's Elegy. No; the village which Gray describes with its curfew bell, its ivy-mantled tower, and lowing herds wending slowly o'er the lea, has no future in Greater London; this kind of village life will have to be relegated to the country beyond. The sort of village that I have in my mind, consisting of about twenty cottages or small houses, with occasionally a group of houses of a larger type, will exist more on the lines of the best type of a small suburban community, such as is to be seen in many outlying districts to-day, and the sort of country that would be reserved between them would be agricultural land pretty much as we see it now, with perhaps more dairy farms and an increase in market gardens, orchards, allotments, and every kind of intensive culture.

There would, of course, be great difficulties in regard to satisfying owners whose land was to be kept open, but much could be done in a matter of this kind by negotiation, and perhaps by compensation, collected by a rate levied on all built-up areas in the vicinity of undeveloped land.

The sum total of such an arrangement would certainly result in an enhanced value all round.

Probably to restrict permanently lines of railway communication and other routes of public conveyance would be found to have the same effect as limiting the building areas. And this indirect way of dealing with the difficulty might in the end prove the best.

NATURE RESERVATIONS.

Quite another matter is the provision around London of a chain of Nature reservations. In Epping Forest and Richmond Park London possesses unbroken areas and stretches of natural scenery of which she may be justly proud. The value of these great open spaces, each of which covers considerably over 4,000 acres, is inestimable.

They are, however, insufficiently accessible for those inhabitants who dwell in the North, West and South-east. To provide similar amenities for the people dwelling in these districts there are needed similar reservations in the direction of Edgware and Eltham. The London Society in this plan suggest the acquisition of two such areas. . . .

The addition of two magnificent Nature reservations would be a great boon to London, but when we consider the wooded heights that encircle Vienna, when we consider that before many years the opportunity of having a chain of Nature reservations around London will be lost for all time, when we realise the mistakes that result from the national method of compromising and half-doing things, we realise that to be satisfied with two more extensive reservations is not enough. We want a chain of reservations, and we want them connected together by packways and delightful drives. Some such scheme as this has been proposed by the London Society as regards their outer circular roadway.

In advocating the preservation of all these open areas in Greater London, it ought not to be a case of how little can we do with, but rather how much can we enjoy. We have to remember that recently there have been introduced enormous improvements in passenger transit, and that therefore the value of land around London is not so much less 15 miles out than it was some years ago 5 miles out, and that the tendency in the future will be for it to equalise. But as we get further out it increases in area in the square of the distance, and therefore if we look at the matter from the point of view of the Londoner, instead of regarding it with the limited parochial vision which to-day seems to settle all these questions, we realise that it does not mean the loss of thousands of acres of desirable building land which the little Londoner thinks he can ill spare.

CLINKER ASPHALT AT HORNSEY.

The Hornsey Town Council at their meeting on the 18th instant resolved that the usual triennial tenders for asphalt footway and carriageway work be not invited, having regard to the successful results in respect of durability and economy which have obtained during the past three years in the manufacture and laying, by the town council's own staff, of clinker asphalt.

This new asphaltic material, manufactured with destructor clinker and Mexphalte, has been used for the resurfacing in single and double coat work of large areas of water-bound macadam roads. Its use has also, during the past three years, been successfully extended to the repairing and renewing on existing concrete foundations of carriageways and footways originally laid in natural rock and mastic asphalt.

Darlington's "Rubbish Campaign."—A "rubbish campaign" has been inaugurated in Darlington. It will continue for a fortnight, during which time appointed collectors will gather from houses goods which would otherwise be stored away as lumber, and the proceeds of a sale will be handed over to patriotic funds.

War Bonuses for Corporation Employees.—In view of the increased cost of living, the Barnsley Town Council have granted additional war bonuses of 2s. per week to street sweepers, and other employees receiving less than 20s. per week, and 3s. per week to all employees excepting those who had been dealt with by individual committees. Burton-on-Trent Town Council last week decided to grant all unskilled workmen an additional war bonus of 3s. per week, women engaged on temporary work to receive the same amount, and youths 1s. The previous bonus was given in March. It was stated that a war bonus to the lower-paid members of the municipal staff was under favourable consideration.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

A meeting of the council of the Institution of Municipal and County Engineers was held at 92 Victoria-street, Westminster, on the 9th inst., when there were present Messrs. John S. Brodie (president, in the chair), J. Patten Barber, William N. Blair, John A. Brodie, Charles Brownridge, George F. Carter, J. William Cockrill, P. Dodd, Ernest J. Elford, T. W. A. Hayward, L. S. McKenkie, Frank Massie, W. H. Prescott, Norman Scorgie, Henry Stilgoe, H. T. Wakelam, J. P. Wakeford, James A. Webb, Charles F. Wike, Edward Willis, Oliver E. Winter, Ernest E. Worrall, the consultant secretary, the secretary, and the acting secretary.

R.I.B.A. ARTERIAL ROAD CONFERENCE.

On the recommendation of the Town Planning Committee it was resolved that Mr. Hayward and Mr. Webb, the representatives to this conference, should in principle support the resolution to be submitted to the Local Government Board.

COMPULSORY TOWN PLANNING.

Attention was drawn by the same committee to a paper on this subject read at a meeting of the Town Planning Institute by Councillor Harrison, of Birmingham. It was resolved that it should be left in the hands of the chairman of the committee, Mr. H. E. Stilgoe, to take such action in the matter as he thought to be in the interests of the institution.

SUB-DIVISION OF INDIAN DISTRICT.

It was resolved, on the recommendation of the General Purposes Committee, that the consideration of this subject be deferred until the appointment of a successor to Mr. A. F. Henderson, municipal engineer, Chittagong, Eastern Bengal, as hon. district secretary.

STANDARDISATION.

It was resolved, on the recommendation of the Standardisation Committee, that Messrs. P. Dodd, E. J. Elford, and E. Willis be appointed to form a sub-committee to consider and report on road forms of statistics.

It was also resolved that the sub-committee for Refuse Disposal undertake the drafting of standard forms for statistics in reference to the collection and disposal of house refuse and report to the committee. It was decided that Mr. P. Dodd be co-opted a member of the sub-committee.

The consideration of a Standard Form of Articles and extended periods for repayment of loans in respect of works in reinforced concrete was deferred.

STREET LIGHTING SPECIFICATIONS.

A letter was received from the Institution of Electrical Engineers regarding the publication of a majority report on street lighting specifications. It was resolved that this matter be referred to the delegates appointed by the council to attend this conference.

COUNCIL'S NOMINATIONS.

The following motion, of which due notice had been given, was received from the president, and carried *nem. con.*:—

"That in future a meeting of the council shall be held in the month of December in each year, at which nominations shall be invited from the chair for the positions of president, vice-presidents and hon. treasurer for the ensuing year. If such nominations exceed the respective vacancies or offices to be filled, a ballot thereupon shall be taken and the members elected as the result thereof shall be nominations of the council for such offices as required by By-law 14; and that the resolution on the same subject, dated December 2, 1911, be and is hereby rescinded."

ANNUAL MEETING ARRANGEMENTS.

The arangements for this meeting were left in the hands of the president-elect, Mr. P. H. Palmer.

THE ORPHAN FUND.

A meeting of the South-Western District of the Institution of Municipal and County Engineers was held at the Guildhall, Exeter, on Saturday last to consider the following resolution submitted by the Orphan Fund Committee:—

"That one or more Orphan Fund stewards be appointed in each district to advocate the claims of the fund, to promulgate its work, to solicit and collect subscriptions and donations, to investigate cases needing assistance, and to report to the secretary on all questions relating to the work of the fund."

The matter was considered at length, and the following resolution was carried unanimously:—

"That this meeting of the South-Western District of the institution heartily approve of the resolution submitted, and that arrangements be made to co-operate on the lines laid down in the resolution."

The following were asked to act as stewards: Somerset—Mr. G. R. Folland, acting county surveyor; Devon—Mr. W. P. Robinson, county surveyor, No. 2 Division; Mr. R. M. Stone, county surveyor, No. 3 Division; and Mr. C. O. Baines, surveyor to the Paignton Urban District Council; Dorset—Mr. S. J. James, surveyor to the Sherborne Rural District Council; Cornwall—Mr. L. D. Thompson, county surveyor.

It was further resolved that the hon. district secretary submit the following resolution to the secretary of the institution:—

"That, in the opinion of this meeting, the time has arrived when the council of the institution should consider the advisability of contributing to the Orphan Fund from the funds of the institution at least 1s. per head for each member per annum."

INSTITUTION OF MUNICIPAL ENGINEERS.

President—MR. HENRY C. ADAMS, M.INST.C.E., M.I.MECH.E., F.R.SAN.I.

President-Elect—MR. EDWARD WHITWELL, F.I.S.E., M.S.A., Engineer and Surveyor, Abersychan Urban District Council. (Lieut. R.N.V.R.)

ANNUAL MEETING.

The eighth annual general meeting will be held in London on Saturday, January 6th.

PROGRAMME.

11.30 a.m.—Council meeting.

11.45 a.m.—Meet in the council chamber, No. 4 Southampton-row, W.C.

12 (noon).—Annual general meeting.
Minutes of last annual general meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of president and council for the year 1916-17.
Installation of president.
Any other business.

12.45 p.m.—Adjourn for lunch.

2.30 p.m.—Reassemble in council chamber.
Presidential address.
Discussion on the following papers to be presented to the meeting:—
"A *Résumé* of Public Health Matters," by G. Belson Chilvers, M.R.SAN.I. (Member).
"Practical Road Work," by Geo. Rodley (Member).
"Notes on the Use of Electricity in Municipal Engineering," by Horace Boot, M.I.E.E., M.I.MECH.E. (past-president).

B. WYAND,
Secretary.

39 Victoria-street, S.W.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

SANITARY INSPECTOR.—December 29th.—Gellygaer Urban District Council. £120 per annum.—Mr. F. T. James, clerk, Council Offices, Hengoed, *vid* Cardiff.

INSPECTOR OF NUISANCES.—December 30th.—Whitby Urban District Council.—Mr. W. S. Gray, clerk, Council Offices, Whitby.

ENGINEER, SURVEYOR, AND INSPECTOR.—January 6th.—Street Urban District Council. £175 per annum.—Mr. S. T. Clothier, clerk, Council Offices, Street.

SURVEYOR AND INSPECTOR.—January 15th.—Dorking Urban District Council. £250 per annum.—Mr. W. J. Hodges, clerk, 64 South-street, Dorking.

ASSISTANT ENGINEERS. March 31st. Indian Public Works and State Railways Department. Not less than twenty-one and not more than twenty-four years of age on July 1st.—The Secretary, Public Works Department, India Office, London, S.W.

TEMPORARY ASSISTANT.—Corporation of Tenby. 30s. per week.—Mr. B. Morley, borough surveyor, Tenby.

ASSISTANT ENGINEER.—Public Works Department, Straits Settlement. £360—£15—£480.—Messrs. Gregory, Eyles & Waring, 12 Dean's-yard, Westminster, S.W.

ASSISTANT FOR SURVEYS. — Southampton County Council.—The County Surveyor, The Castle, Winchester.

MUNICIPAL COMPETITIONS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

LEON (Spain).—August 15, 1917.—Schemes are invited for a water supply, and also for the improvement of the sewerage system. A prize of £1,000 will be awarded to the author of the selected scheme.—Secretaria del Ayuntamiento, Leon, Spain.

MUNICIPAL CONTRACTS OPEN.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

Buildings.

PEMBROKE. January 2nd. For cement plastering work on various cottages, for the urban district council.—The Town Hall, Ballsbridge, co. Dublin.

Engineering: Iron and Steel.

MANCHESTER.—December 28th.—For the supply and erection of water-tube boilers and induced-draught plants, for the Electricity Committee.—Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

SCUNTHORPE.—January 3rd.—For the supply of an electric motor and pump combined, the latter designed for a discharge of 300 gallons per minute on a lift of 65 ft.; also a transformer, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, Council Offices, High-street, Scunthorpe.

DURBAN.—January 3rd.—For the supply of a 3,000-kw. steam turbine alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation.—Electricity Department, Dock-road, Cape Town.

WIGAN. January 8th. For the supply of a 30-h.p. motor tower wagon, for the Tramways Committee.—Mr. F. Buckley, general manager, Corporation Tramways, Market-place, Wigan.

ALNWICK.—January 8th.—For providing and fixing four sluice valves, for the rural district council.—Mr. H. W. Walton, clerk, Alnwick.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Iverell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

AUCKLAND (New Zealand).—January 21st.—For the supply of mild-steel or iron gates and fencing, for the Harbour Board.—Messrs. W. & A. McArthur, Canberra House, 18-19 Silk-street, Cripplegate, London, E.C.

Roads.

SOMERSET.—December 27th.—For surface tarring on main roads, for the county council.—Mr. Gordon R. Folland, acting county surveyor, County Surveyor's Office, Wells.

BEXLEY.—December 27th.—For the supply of tar, highway materials, best glazed stoneware socketed pipes, and best Portland cement, for the urban district council.—Mr. W. T. Howse, surveyor.

FINCHLEY.—December 28th.—For the supply of tar and gritting material, for the urban district council.—Mr. H. Catchpole, deputy surveyor, Council Offices, Church End, Finchley.

CANNOCK.—December 29th. — For the supply of refined tar and work of tar-spraying, for the urban district council.—Mr. R. Blanchard, engineer and surveyor, Council Offices, Cannock.

CONWAY.—December 31st.—The rural district council are advertising for a second-hand stone crusher, to break from 27 to 30 tons per day.—Mr. H. T. Davies, surveyor, Rose Hill-street, Conway.

RUISLIP-NORTHWOOD.—January 1st.—For the supply of ½-in. washed granite siftings, and tar-spraying, for the urban district council.—Mr. Edmund R. Abbott, clerk, Council Offices, Oaklands Gate, Northwood.

ROMFORD.—January 1st.—For the supply of broken granite, for the rural district council.—The Highway Surveyor.

TWICKENHAM.—January 3rd. — For sewering, levelling, kerbing, paving, channelling, and making good part of a street, for the urban district council.—Mr. Fred. W. Pearce, surveyor, Town Hall, Twickenham.

BOURNE.—January 6th. For the supply of 5,000 tons of granite, and 1,000 tons of slag, for the rural district council.—Mr. T. Lake, district surveyor, Bourne.

NORTH RIDING.—January 10th.—For team labour and hauling (day work and by tonnage), and for macadam and steam rolling, for the county council.—Mr. W. G. Bryning, county surveyor, County Hall, Northallerton.

DURHAM.—January 13th.—For tar-spraying on the main roads, for the county council.—Mr. Albert E. Brookes, county surveyor, Shire Hall, Durham.

WORCESTERSHIRE.—January 20th. — For the supply of granite, blast-furnace slag, and tar-macadam, for the county council.—Mr. C. F. Gettings, county surveyor, 30 Foregate-street, Worcester.

CHISWICK. — Offers will be received for several 350 to 400 gallon water vans.—The Engineer, Town Hall, Chiswick.

Stores.

HORNSEY.—January 8th.—For the supply of road materials, paving, granite and general mason's materials, mason's and pavior's work, Portland cement, forage, iron and steel, disinfectants, and cartage, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor, Town Hall, Southwood-lane, Highgate, N.

PLYMOUTH.—January 15th.—For the supply of paints, varnishes, ironwork, petroleum oil, broomheads, household brushes, rope, iron and steel, pitch-pine, deals, flooring, carbolic powder, Portland cement, lubricating oils, tar and pitch, painter's brushes, explosives, soap, wood blocks, creosote, disinfectant fluid, granite kerbs, setts, white lead, red lead, linseed oil, turpentine and turpentine substitute, refilling machine revolving brooms, benzoline and motor spirit, tools, indiarubber goods, hose, and ship chandler's goods, for the corporation. — Mr. James Paton, borough engineer and surveyor, Municipal Offices, Plymouth.

Miscellaneous.

OXFORD. December 27th. For the supply of ironmongery, castings and wrought-iron work, oils, paints, and disinfectants, for the corporation.—City Engineer, Town Hall.

Correction of Advertisement.—On p. xiv. of our issue of last week there appeared an advertisement in which the Durham County Council invite tenders for the tar-spraying of their main roads during the coming year. The date of issue of the advertisement was erroneously given as December 12, 1917. It should, of course, have been December 12, 1916. The notice, in accordance with the terms of the order, is repeated this week, but our attention was drawn to the mistake too late to enable us to make the necessary correction in the whole of the issue. The advertisement will be found on p. xi.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

6.—Institution of Municipal Engineers. Annual Meeting, 4 Southampton-row, London, W.C.

APPOINTMENTS OPEN.

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REQUIRED Temporarily, in County Surveyor's Office, Winchester, an Assistant for Surveys, Drawing and General Work in connection with maintenance of roads and bridges, preferably one having already experience in County or Municipal work.—Apply by letter, stating age, experience, &c., and salary required, to County Surveyor, The Castle, Winchester. (3,204)

WANTED, Temporary Assistant, for short period, ineligible for Army, able to level, good draughtsman, tracer, &c.; keep wages and other surveyor's accounts, and be experienced in routine duties of surveyor's office.

Wages, 30s. per week. Applications, in own handwriting, stating experience, with copies of three recent testimonials, to be sent to the undersigned.

B. MORLEY,
Borough Surveyor,
(3,206) Tenby.

APPOINTMENT WANTED.

PREPAID *Advertisements under this heading are inserted at the rate of* ONE PENNY *per word, with a minimum charge of* 2s. THREE *consecutive insertions given for the price of* TWO.

CIVIL ENGINEER AND SURVEYOR, ten years' experience, desires spare time employment; tracings, &c., neatly executed; edging and colouring carefully done; terms moderate.—Box 1,597, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,205)

TENDERS WANTED.

RUISLIP-NORTHWOOD URBAN DISTRICT COUNCIL.

The above Council invite Tenders for

¾-in. Washed Granite Siftings, and
Tar-spraying.

The Chippings to be delivered free at Northwood, Eastcote and Ruislip Metropolitan Stations respectively, in such quantities and at such times prior to May, 1917, as the Council's Surveyor may direct.

Further particulars can be obtained from the Surveyor to the Council.

Endorsed Tenders to be sent to the undersigned not later than 10 a.m. on January 1st, 1917.

The Council reserve the right to divide the Contracts. The lowest or any Tender not necessarily accepted.

EDMUND R. ABBOTT,
Clerk to the Council.

Council Offices,
Oaklands Gate,
Northwood.
December, 1916. (3,200)

SCUNTHORPE URBAN DISTRICT COUNCIL WATER DEPARTMENT.

The above Council invite Tenders for an Electric Motor and Pump combined, the latter designed for a discharge of 300 (three hundred) gallons per minute on a lift of 65 (sixty-five) feet, mounted on suitable steel frame for suspension, with necessary suction and discharge pipes.

Also a Transformer, for an incoming pressure of 2,200 volts, with H T Switch and L T Starting Panel.

It is most essential that the time of delivery is stated. Further particulars, if desired, may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Electric Plant," to be delivered to G. E. Davy, Esq., Clerk to the Council, High-street, Scunthorpe, on or before Wednesday, the 3rd January, 1917.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
HERBERT HEAP, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

Council Offices,
High-street,
Scunthorpe. (3,202)

BOROUGH OF PLYMOUTH.

Notice is hereby given that after the expiration of 10 days from the date hereof the Corporation intend to enter into Contracts for the Supply of the following Goods and Materials for one year:—

Schedule No. 3.—Section A.—Paints.
Section B.—Varnishes.
.. .. 5.—Ironwork.
.. .. 7.—Petroleum Oil.
.. .. 8.—Broomheads.
.. .. 9.—Household Brushes.
.. ,, 10.—Rope.
.. ,, 11.—Iron and Steel.
.. ,, 13.—Pitchpine, Deals, Flooring, &c.
.. ,, 14.—Carbolic Powder.
.. ,, 15.—Portland Cement.
.. ,, 16.—Section A. — Lubricating Oils (Samples to be submitted by Tenderers).
Section B.—Fuel Oil.
.. ,, 17.—Tar and Pitch, includes refined tar for use in the construction of tarred macadam roads and for tar-spraying.
.. ,, 18.—Painter's Brushes.
.. ,, 19.—Explosives.
.. ,, 22.—Soap (Yellow, Carbolic, Toilet, Soft).
.. ,, 23.—Wood Blocks, Soft.
.. ,, 24.—Creosote.
.. ,, 28.—Disinfectant Fluid.
.. ,, 29.—Granite Kerbs, Setts, &c.
.. ,, 30.—White Lead, Red Lead, Linseed Oil, Turpentine and Turpentine Substitute.
.. ,, 31.—Refilling Machine Revolving Brooms.
.. ,, 33.—Benzoline and Motor Spirit.
.. ,, 34.—Tools.
.. ,, 35.—Indiarubber Goods, Hose, &c.
.. ,, 36.—Ship Chandler's Goods (Sundry Oils, Waste, Grease, Metal Polish, Matches, &c.).

With the exception of Schedules 4, 17, 19, 21, 23 to 29 inclusive, 31, 32, 37, 38, the Schedules include for the Supply and Delivery of Materials to Wrangaton Station, Great Western Railway, about 13 miles from Plymouth, for the Plymouth Borough Asylum.

Tenders must be based on the whole of a Schedule (with the exception of Schedules Nos. 3, 4, 16, 21, 22, 26, 29, and 36), and not on any particular item contained therein.

(Separate Tenders will be considered for Sections A and B of Schedule No. 3, also Sections A and B, Schedule 16, and Sections A, B, C, Schedule 26.)

Schedules may be obtained on payment of a deposit of £1 in cash for each Schedule. The deposits on the Schedules will be returned, provided *bonâ-fide* Tenders are received on or before the 15th January, 1917. Should the Contractor withdraw his Tender, or fail to send in one, the amount of his deposit will be forfeited, and the Contractor who applies for the Schedules must do so on the distinct understanding that he is willing to abide by the terms of this advertisement.

The lowest or any Tender will not necessarily be accepted.

Tenders to be delivered not later than Monday, January 15th, 1917, addressed to the undersigned.

JAMES PATON,
Borough Engineer and Surveyor.

Municipal Offices,
Plymouth.
December 15, 1916. (3,207)

WANTED, by the Conway Rural District Council, a Stone-Crusher (second-hand), in good condition, to break from 27-30 tons per day; complete with screen and travelling wheels. Price and full particulars to be sent to me on or before the 31st inst.

H. T. DAVIES,
Surveyor to the Council.

Rose Hill-street,
Conway. (3,193)

The Surveyor

And Municipal and County Engineer.

Vol. L. DECEMBER 29, 1916. No. 1,302.

Minutes of Proceedings.

Sewage and Food Supply.

In connection with the present agitation for increased home food supplies, it has been suggested that large areas of grass lands should be ploughed up and utilised for the cultivation of crops. A correspondent in a daily contemporary points out that such a measure would necessitate the provision of much greater quantities of fertilising material than are available. The problem may possibly be solved by the combined efforts of our new Ministers for Agriculture and the Food Controller. In a Sunday paper, however, it is suggested that we have the necessary supplies of manure or fertilising material to enable us to do without any fresh supplies. [illegible] Municipal engineers will at once point to the accumulations of sewage sludge all over the country. It is true that the past sewage sludge has not always proved of much value as a manure in many cases where it has been tried, but there are a number of other cases where the farmers readily take all the sludge produced at the adjacent sewage works, and some even pay for the privilege of doing so. There is the Native Guano Company, which has for many years supplied, and, we believe, still continues to supply, a marketable manure produced from sewage sludge. Various other attempts, some of less success, have been made to prepare a manure from sludge, and there is no doubt that it can be done, especially if the question were taken up by the new Ministers for Agriculture. It is, of course, well known that ordinary sewage sludge contains only small percentages of ingredients which have a real manurial value, and in most of the processes by which it has been converted into saleable manure certain chemicals have been added in order to enrich it and make it suitable for the purpose.

On the other hand, much brighter prospects for the utilisation of sewage sludge have been opened up by the introduction of the activated sludge method of sewage treatment. A considerable amount of research work in this direction was done by Dr. G. J. Fowler at Manchester before he left to take up his new appointment in India, and we believe the work has been continued along the same lines since then, although no records of further results have been published. Other chemists have, however, also been engaged on similar investigations, and we printed a valuable article by Mr. W. B. Copeland, of Milwaukee, and Mr. G. W. Fuller, of New York, in our issue of November 24th last, dealing very fully with the subject. It appears that the sludge from the activated sludge process contains about twice as much nitrogen as the sludge from other processes, and to this extent possesses considerable advantage over ordinary sludge. In both cases, however, the chief difficulty is that of removing the water contained in the sludge. This side of the question is dealt with thoroughly by Mr. Fuller in the article referred to above, and he refers to the Dickson yeast-fermentation process, which, he states, "is being installed on a large scale by Mr. Watson at Birmingham." It is obvious that investigations of this character carried out by a few local authorities and private persons in a small way and without sufficient resources to enable them to deal with the matter on a large scale, must take a considerable amount of time before a sound practical solution is attained, and for this reason we suggest that the matter which should be taken in hand by the Ministers for Agriculture. In the past many years have been heard protesting against the waste caused by the present method of sludge disposal, but very little heed was given to them. The existing shortage of fertilisers, together with the necessity for increasing the acreage of arable land for the cultivation of wheat, in order to increase our home-grown supplies of food, should furnish ample reasons for resolute action being taken by the Government to prevent such waste, and Mr. Prothero could confidently call upon all municipal engineers to assist him in attaining that object.

Economy in Lighting.

As a war measure, economy in lighting has been enjoined for two reasons which are entirely distinct. In the first place, there are the regulations with regard to public and private lighting which have been made as a precaution against attacks by hostile aircraft. There is no doubt that the carrying out of these regulations, necessary as they are in themselves, has been accompanied by appalling waste, owing to the reduction of illumination by the primitive method of obscuring lights, which thus consume as much of the illuminant as if full advantage were still being derived from them. In the second place, the need for economy in lighting arises from the more direct and urgent need for economy in fuel. This aspect of the question was admirably dealt with in the paper on "War Economies in Lighting," which was read at the last meeting of the Illuminating Engineering Society by Mr. L. Gaster, the hon. secretary. The desired economy has been sought in two ways—namely, the passing of the "Summer-time Act," and the encouragement of

reduction in private artificial lighting. As regards the effects of the Summer-time Act, it is interesting to observe that, as far as direct saving is concerned, the principal results have been achieved in the purely residential districts. In Ealing, for example, it is stated to have been as much as 23 per cent, while 13 per cent was saved in the residential quarter of Manchester. We agree with Mr. Gaster that, inasmuch as "daylight saving" will in all probability become a permanent feature of our national life, it is very desirable that the ascertainable results of its initial trial should be fully investigated and noted for future guidance.

The question of a general reduction of private artificial lighting is one of much greater difficulty, and it is necessary for its proper consideration to realise at the outset that mere reduction in consumption if pushed beyond a certain limit is not national economy, but national extravagance of a very dangerous kind. Consider, for example, the conclusions arrived at in the Home Office report on factory lighting, that defective illumination leads to diminished output, spoiled work, and more accidents. It is a matter of no great difficulty in the face of such a statement to strike a balance between the saving in lighting and the waste in other directions, and to see that the interests of real economy are best served by a reasonably liberal use of artificial lighting. This applies with the greatest force perhaps to our munition factories, which no one would think of handicapping by restricting the supply of gas or electricity either for power or for lighting, but, as Mr. Gaster truly pointed out, it applies also to all productive work, from the economic as well as from the hygienic point of view. Thus the problem of true economy really resolves itself into the obtaining of definite information as to the minimum safe intensities of illumination that are actually required for the various manufacturing processes.

The whole subject is one which does not appear to have received that attention at the hands of the authorities which its importance undoubtedly merits. The Committee on the Health of Munition Workers has been carrying out many detailed investigations into the effect on output in munition factories of changing hours of work; and similar researches undertaken in France, and described in the Chadwick Lectures recently delivered by Professor William Stirling, showed beyond doubt that if the hours of work are increased past a certain point the output first becomes stationary and ultimately falls off. Illuminating engineering in relation to factories should be regarded as an almost equally important branch of the admirable "Welfare Work" carried out under the Ministry of Munitions, and it would be most instructive if, while detailed investigations into other variations in conditions affecting the health and efficiency of munition workers are being made, the influence of changing conditions of lighting could also be studied.

* * *

The Edinburgh Tramway Difficulty.

The problem of the Edinburgh tramways is surrounded with so many difficulties that there does not seem a hopeful prospect of any new system being installed for a year or two. This is particularly unfortunate for the Scottish capital, which certainly deserves a better fate than to have to rely upon what is virtually an obsolete tramway system, the defects of which have been notorious. The question of future policy is considered in a report issued by Sir Thomas Hunter, the town clerk, who, dealing with the arrangements in view of the termination of the lease of the tramway company in June, 1919, points out that the corporation will have to decide whether to continue the cable system, at least for a time, or supersede or supplement it by some other system. The tramway service can only be continued at the close of the lease in two ways—(1) by continuing the cable system, or (2) by installing a new system to take its place. As regards the latter alternative, which, of course, provides the practical solution, it would be necessary to obtain 200 new cars by July 1, 1919. There would be difficulties in doing this in normal times, but industry is now being carried on under war conditions, and unless the embargo of the Ministry of Munitions is removed by July next it will be impossible to make and deliver the new cars. The supply of electric current is another consideration, the obstacles to which are similar to those affecting the provision of cars. With respect to the first alternative, Sir Thomas Hunter points out that the only practicable course open would be to purchase the company's cars, and according to the terms of the agreement this would have to be settled by arbitration. But even this course is dependent upon the consideration whether the corporation have an alternative open to them by which they can be ready to take over the service on July 1, 1919. The outlook is not therefore promising, and meanwhile a third alternative is being advocated in some quarters—viz., a resort to motor 'buses—and the prospect of having to face a set of circumstances which has not yet been officially considered. Here, presumably, the difficulty of providing the vehicles would be as serious as the difficulty of supplying electric cars. Unless therefore something quite unexpected happens the citizens of Edinburgh will have to content themselves with the *status quo* and its attendant drawbacks.

* * *

Housing at Rosyth.

It is perhaps not generally realised that the existence of war conditions for two and a-half years has created an entirely novel housing problem of great magnitude—namely, the problem of providing for the large bodies of workers that have been suddenly brought together in new districts by the exigencies of munition work or other work of national importance. For example, thousands of men have been transferred from the South of England for work at the Rosyth naval base. The result has been the creation of a house famine, not only at Rosyth itself, but also in the neighbouring towns of Edinburgh, Dunfermline, and Kirkcaldy. Some idea of the seriousness of the situation may be gathered from the fact that an Edinburgh landlord recently had no fewer than 100 applications for a four-roomed house which had become vacant. The present position is due in no small measure to the delays which took place before the war in regard to a town-planning scheme for dealing with the 4 miles of country which lie between Rosyth and the old city of Dunfermline. The draft scheme was actually in the hands of Government officials as long ago as 1912, but, owing to delays in London, the fateful month of August, 1914, had arrived before the amended plan was lodged with the Scottish Local Government Board, in whose hands it still remains.

It must not be imagined, however, that the Government have taken no steps to meet the abnormal situation that has arisen. In May, 1915, an Act, known as the Housing (Rosyth Dockyard) Act, 1915, was passed, which gave the Local Government Board power to make arrangements with any authorised society to provide dwelling-houses and gardens for Rosyth dock workers within the Rosyth feuing area. As a result the Scottish National Housing Company (Limited) has been formed, and has feued some 270 acres of land to the north of Rosyth. During the year that has elapsed since its formation, the construction of

600 dwellings has been undertaken, and of these about 200 are either occupied or ready for occupation, while plans have recently been approved for a further 1,000 houses. Further, a new scheme has been brought forward by which it is proposed to offer on reasonable terms to the Admiralty 74 acres of the Gorgie estate, Midlothian, on which 2,225 houses could be built.

* * *

Road Services in France.

The recent announcement that road engineers and surveyors are to be given an opportunity to be of some real assistance in the present great struggle, by assisting in the maintenance of highways in France, which are giving, or have given, way under the tremendous stress of the traffic they are called upon to bear, is naturally arousing the keenest interest. There appears, however, to be some confusion as to whether the scheme applies *only to those who have not yet joined the Army*. The original announcement, if our memory serve us, was that officers of local authorities with special road experience were to be offered commissions, while foremen were to be made non-commissioned officers, and men enlisted in the ranks. More than one correspondent is enquiring, however, whether it would not be fair to offer positions in the new corps first of all to those who have already joined up and have offered their services to the country before it was formed. It would certainly seem to be extremely hard that the claims of those who offered their services early in the war should be overlooked. There are doubtless many young surveyors in the ranks who would willingly offer their services for the new corps, and who would be of much greater value to their country in exercising their professional skill than where they are at present placed. Moreover, our home road problems are so urgent that the skill of those left behind is required to a large extent at all events to cope with them under the existing conditions of manual and material shortage. But it may well be that the fears of those who contemplate preference being given to those who are still in civil life are groundless, for, as Mr. Gilbert Whyatt pointed out in the letter which appeared in our last issue, the original letter from Brigadier-General Maybury clearly asked for information regarding those already serving with the Colours, and stated that an endeavour would be made to secure them for work for which by their training and experience they are peculiarly fitted. There is little doubt that a large proportion of the applicants for commissions in the new corps are those whose names were sent up, in many cases without their knowledge, in reply to this circular.

* * *

Public Health and Building Restrictions.

The regulation of the construction of private dwellings and public buildings by means of by-laws has long been a feature of municipal administration in this country, and more recently the development of the town planning idea has tended to familiarise the public with the notion of the further regulation of what may be called the out of door aspects of town development. By this we mean such things as the density of buildings, the securing of adequate access of sun and air, and the liberal planting of trees. That these things have a direct influence on the public health was the theme of a paper recently written by Prof. Whipple, of Harvard. It is not a little curious that the standard of public health is measured inversely by reference to death-rates, because we have as yet no means of measuring the health-rate, but it is the latter which really counts, and it is for securing a high standard of health in the individuals who make up the community that building regulation in the wider sense is necessary. It is unnecessary in these days to emphasise the purifying influence of sunlight. It is recognised by every expert in the science of hygiene, and to a large extent by the general public as well. Building by-laws, however, in themselves do little or nothing to secure adequate sunlight for every dwelling-house. This can only be done, to use Prof. Whipple's phrase, by a regulation of the space between buildings, coupled with the device of keeping a factory zone separate and distinct from the residential zone. The much abused Model By-laws have rendered a real service so far as the construction of houses affects the public health, and there seems to be no reason why even greater service may not be rendered in the future by regulation of estate development either through the adoption of town-planning schemes or otherwise.

* * *

Piles and Pile-driving.

In another column will be found some extracts from an exhaustive paper on "Pile-driving and the Supporting Power of Piles," which was read by Prof. Henry Adams, M.INST.C.E., at the last meeting of the Concrete Institute. The number of formulæ that have been devised for determining the sustaining power of piles is certainly bewildering, and the utility of some at least of them is discounted by the fact that they give results ranging up to about 450 per cent. The confusion is accentuated by the varying notation used by different investigators, and one very useful feature of Prof. Adams' paper is the conversion of the several formulæ into the standard mnemonic notation approved by the Concrete Institute. By this simple method it is made abundantly clear that many formulæ which were formerly considered as divergent are really identical in every particular except notation, while comparison of any given formula with others becomes a matter of great simplicity. Speaking of reinforced-concrete piles, Prof. Adams pointed out that, as regards driving and supporting power, they differ physically from timber piles both by reason of their extra weight and their friable nature. They should be made with slow-setting cement six weeks before driving, but if made with quick-setting cement they must be left eight weeks, so as to leave ample time for the hardening of the interior. Prof. Adams' concluding sentence is of peculiar interest having regard to his wide experience and exhaustive investigation of the subject. It is this: "The fact is that soils vary so much between the extremes of plastic clay and firm gravel that, whatever rules may be laid down, *personal judgment* must come in as the most important factor, whatever kind of pile or method of driving may be employed."

A Good Word for the War.—From a letter received from a city engineer in Canada we quote the following: "I might say that the war is doing an immense amount of good in drawing the native-born Canadian to the Mother Country, and in conversations returned soldiers state that the 'Old Country' was not asleep, as they had thought. Occasionally one meets with a returned munition worker, who likes to make fun of the old-fashioned and out-of-date machinery still in use, and of the inconvenience of the houses without bath-rooms or electric light, &c. It reminds me of the Boy trying to teach his Father." On another point our correspondent says: "At the present time I am suffering (like most people in similar positions in this country) from the effects of a very severe reduction in salary, due to what is known out here as a 'War cut.' The councils, after years of prosperity and overbooming, find themselves in financial difficulties, and the first step they made was to cut all the salaries of the officials. With the constantly increased cost of living people like myself are feeling the pinch. Even during the good times municipal engineers were never overpaid. . . . The treatment that civic officials received at the hands of the councils leaves much to be desired. Their method of treatment is derived from the United States."

Pile-driving and the Supporting Power of Piles.*

By HENRY ADAMS, M.INST.C.E.

Twenty-five years ago the author read a paper before the Society of Architects upon "Timber Piling in Foundations and other Works." The notes then collected and since added to relate chiefly to timber piles, with which the author has had considerable experience, and upon which much scattered information has already been published; but all driven piles, whatever the material, must behave more or less according to the same laws, and the knowledge gained concerning ordinary timber piles will be likely to enable us to discover the laws and regulate the practice of driving and using piles of other material, including reinforced concrete.

DRIVING PILES.

Ordinary piles are driven by what is called a "pile engine." It is virtually a large hammer, the weight being arranged to fall freely and strike a succession of blows upon the head of the pile. It consists of a tall framework, with vertical guides on the face to keep the hammer or ram in a direct line with the head of the pile. The base of the pile engine is placed just above the finished level of the pile head, so that in driving long piles a high framework is required. It is, however, sometimes impossible to get the framework high enough for this, and it is then set 6 ft. or 8 ft. above the finished level, and a punch, dolly, or follower, of hard wood, hooped at both ends, is used on the head of the pile when it gets as low as the base of the frame, but the blow is not so effective and the method should be avoided when possible; it is said to reduce the effect of the blow one-third, more or less, according to the rigidity of the material. The length of a pile is generally determined by the local conditions of site and soil, the sectional area chiefly upon the load it has to sustain, usually the ratio—

$$\frac{L}{A} = \frac{1}{4} \text{ to } \frac{1}{5}$$

but no general rule can be laid down, as it depends to some extent upon the unsupported length above ground.

PITCHING AND DRIVING.

In pitching a pile care must be taken that it is started in the right place, as it cannot be shifted, but if the point is not truly in line with the axis of the pile, or gets pushed to one side by meeting an obstruction before it has entered very far, the lower end of the pile will be drawn over to the side to which the point leans. In spite of the greatest care they will sometimes be found slightly out of position, and they have then to be drawn back into place by chains, twisted like a surgeon's tourniquet, while being bolted to the other timbers. If it be necessary for them to be scarfed, the upper portion can be adjusted by cutting the scarf a little out of line to suit. All piles are not required to be vertical; in building jetties the outside row of piles is often doubled, the outer pile being a raking one, at 15 to 30 deg. from the vertical, for increasing the stability, acting like a buttress. At the corners of jetties the outer piles are usually raking both ways, say, about 15 deg. from the vertical. When necessity arises piles may be drawn from the bed of a tidal river by lashing empty barges to them and letting them lift by the tide. Against a river wall, or round the foundations of a bridge, piles should be sawn off by a diver as low as he can get at them in preference to drawing them, to avoid any risk of scour and undermining of the foundations taking place. On land a pile may be drawn by lashing a short piece to the top and then prising it up by another balk used as a lever, or by a pair of powerful jacks.

WEIGHT OF RAM.

One of the most interesting questions in connection with pile-driving is the proportion between the weight of ram and the fall to produce a given result. The ram usually weighs from 5 cwt. to 30 cwt., and is allowed to fall, say, from 6 ft. to 20 ft. Upon a superficial consideration it would seem that a ram of 5 cwt. falling 20 ft. would produce the same result as a ram of 20 cwt. falling 5 ft., as they would both have 5 ft.-tons energy, but the proportion of the total energy ($W h$) which is usefully expended in sinking the pile depends *inter alia* upon the ratio of the weight of ram to the weight of the pile. Some of the total energy is always wasted.

A light ram with a long fall will not have the same effect as a heavy ram with a short fall. In practice it is found that with too great a fall the effect of the blow is to bruise and "broom" the head of the pile, or to shiver the timber instead of to force it downwards. A heavy ram, producing the same effect in distance driven as a light one with greater fall, does less injury to the pile. Dobson says, "In working with a fall from 12 ft. to 20 ft. it is common for every tenth pile to be more or less shaken." Of course, he meant to say "one pile in ten." It is as if the top of the pile were driven down while the bottom remained stationary, owing to the inertia of the mass of the pile.

For the first few blows the pile goes down a considerable distance, which gradually becomes less at each blow until the resistance is so great that it will not go any further, or, as it is technically called, "refuses." Were the material of the pile perfectly rigid and inelastic, the impact, however slight, would produce an infinite pressure, but the material is very elastic, and so the fibres of the pile are compressed without the point going any further, and the amount of this compression and the elasticity are strikingly shown in the rebound of the ram when the pile refuses.

THE SUPPORTING POWER OF PILES.

The sustaining power of a pile depends chiefly upon three circumstances –

(1) The resistance at the point or shoe to further penetration; (2) The friction of the earth on the sides of the pile; and

(3) The strength, as a column, of the pile above the ground or above the firm subsoil.

Although it would seem that these are simple elements, each of which could be fairly estimated, the complexity of the case is shown by the numerous formulæ which give results ranging up to about 450 per cent.

In Newman's "Earthwork Slips and Subsidences" the frictional resistance of timber piles is stated to be less through wet soils than dry, in the following proportions:

In sandy gravel 5 to 10 per cent less.
In sand about 12 per cent less.
In sandy clay or gravelly clay about 40 per cent less.

Experiments with cast-iron piles by McAlpine gave about ½ ton per square foot of surface as the supporting power from friction when sunk 20 ft. to 30 ft. in rocky gravel. He considers it would amount to 3 tons per square foot in fine earth, but this seems to be an extravagant assumption. In experiments made previous to the sinking of concrete piles for the works of the Vienna-Danube Sand Dredging Company in 1909 it was found that the frictional resistance was about 14·19 lb. per square inch of surface = 2,054·36 lb. per square foot, or just over 18 cwt.

G. B. Bidder was of opinion that "in clay or wet soils it was not advisable to trust a greater weight than 12 tons upon each pile, but in gravel there was scarcely any limit to their vertical bearing strength."

French engineers (*vide* Berg's "Safe Building") allow a pile to carry 50,000 lb., provided it does not sink perceptibly under a ram falling 4 ft. and weighing 1,350 lb., or does not sink ½ in. under thirty blows.

A common rule for safe dead load on each pile is 5 tons per square foot of cross-section in soft ground, or 1 ton per inch side of square piles in firm ground.

The New York Building Regulations permit a load of 20 tons per pile, but the size is not specified.

The author believes they use Wellington's formula for safe load.

Haswell (Minutes of "Proceedings" of the Institution of Civil Engineers, cxv., p. 318) says: "In deciding upon a factor of safety in a formula for pile-driving, the following elements must be considered: The friction of the machine; the resistance of the atmosphere to the fall of the ram and the cushioning on the head of the pile, however square it may be dressed off; the want of verticality both in the fall

* From a paper read at a meeting of the Concrete Institute held on the 21st inst.

of the ram and in the plane of the pile, and the consequent lateral vibration; the inertia, the vibration and condition of the soil. Were all the conditions known definitely and allowed for, a factor of safety of 2 would be ample, but as the formulæ do not take account of all the conditions a larger margin is necessary. In some ascertained supporting powers recorded by Trautwine they were found to be from 2·3 to 3·7 times greater than given by the formulæ.

There seems to be no general rule as to the factor of safety it is desirable to adopt, the practice appears to vary from 2 to 10, the former being suitable for dead loads and the latter for live or vibrating loads. Intermediate factors would be produced with varying proportions between the dead and live loads. Obviously, unless the ultimate resistance given by the formula is reliable, the resulting factor is unknown.

In Dobson's "Foundations and Concrete Works" (Weale's Series) we are told that "of the comparative effect of impact and pressure in driving piles we as yet know nothing, and the question is so complicated, from the great number of points that have to be taken into consideration in reducing the results of experiment into a definite form from which some rule for our guidance might be obtained, that we can only lay down in general terms the following empirical rule that in ordinary cases if a pile will safely resist an impact of 1 ton it will bear without yielding a pressure of 1½ tons," and he gives W = impact, therefore safe load = ½ W.

Dobson is, however, wrong in his theory, he assumes that the force of a blow is measured simply by the product of the weight into the velocity, and this assumption leads him to conclude that a 1-ton ram with a fall of 16 ft. will have the same effect on the head of a pile as a 2-ton ram falling 4 ft., while the former takes double the expenditure of power to raise it. In other words he says $f = mv$ instead of $ft = mv$, which is the well-known formula where f = force, t = time, m = mass = $\frac{w}{g}$, v = velocity—that is, a force f, acting for time t, will move a mass m, with a velocity v, but action and reaction are equal in magnitude but opposite in direction, therefore a mass m moving with a velocity v, and expending its energy in time t, will produce a mean pressure—

$$f = \frac{mv}{t}.$$

Weight = product of mass into force of gravity, or $W = mg$, therefore

$$m = \frac{W}{g}, \text{ or } f = \frac{Wv}{gt}, \text{ instead of } f = Wv$$

as Dobson puts it. The same error is made by Molesworth, and a table of results is given assuming that the force of the blow varies as the square root of the fall instead of directly as the fall. The product mv gives the momentum in its original sense. It is also known as quantity of motion, but it cannot be compared with force or pressure unless time be taken into account.

A worked example will perhaps make this clear. Let W = 0·25 tons, h = 20 ft., S = set of head of pile ¾ in., then

$$v = \sqrt{(2gh)} = 35{\cdot}7 \text{ ft. per second,}$$

but v varies from 35·7 to 0 while passing through the ¾ in., therefore mean $v = \frac{35{\cdot}7}{2} = 17{\cdot}85$ ft. per second, and ¾ in. = $\frac{1}{16}$ ft., therefore time occupied in passing through ¾ in. = 1/17·85 × 16 = 1·285 of a second. Then by formula

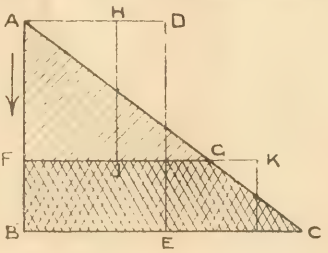
$$f = W = \frac{wv}{gt} = \frac{0{\cdot}25 \times 35{\cdot}732}{32{\cdot}2 \times 1{\cdot}285} = 7{\cdot}95 \text{ tons,}$$

but if the exact fraction be taken it will give 80 tons mean pressure. By formula

$$W \times S = W \times h = 0{\cdot}25 \times 20 = 5 \text{ ft.-tons,}$$

or a mean pressure of $\frac{5}{\frac{1}{16}} = 80$ tons, as before.

It will be observed that S is taken as the set of the head of the pile, and attention must be directed to one very important point. The distance the head of the pile moves after being struck is the criterion of the resulting force in pounds, but only part of this force is returnable as supporting power, some of it is expended in compressing the pile, and any formula that does not take account of the compression of the pile as well as the penetration of the point can only be approximately true. The resistance at the head of the pile begins at zero and terminates at such a pressure that the total movement multiplied by the average pressure equals the foot-pounds energy of the blow. This resistance is shown approximately in the accompanying figure, where A B is the total movement of the head of pile at the last blow, and the horizontal ordinates between A B and A C represent the corresponding pressure at each point of the movement, giving an average resistance of A D or B E, which is equivalent to the 80 tons just worked out. Suppose the point moves one-third of the distance moved by the head, then when the head has gone down from A to F the point will begin to move, dividing the triangle of resistances into two areas, the upper one A F G representing the foot-pounds resistance of the pile to compression with an average of A H or F J, and B E G C the foot-pounds resistance



of the point to penetration with an average F K, or B L, but B C represents the ultimate pressure or the resistance in pounds to further penetration, assuming that the resistance varies in direct ratio to the movement. B C is seen to be independent of F B, and therefore the supporting power must be measured by the movement of the head rather than by the movement of the point.

Let W = weight of ram in pounds, and h = height of fall in inches, then B C = $2W\frac{h}{S}$, A B, or in our notation

$$\text{I} \quad \frac{2\text{I}W\text{I}}{S} \quad 2W\frac{h}{s}$$

If it should be desired to measure the supporting power by the average resistance of the point to penetration, it will be seen that the area F G C B is $\frac{4}{9}$ of the area A B C, F S being ⅓ A B, or if s be penetration of the point and S the movement of the head, the proportion of the whole energy exerted which is absorbed in penetration will be

$$\frac{W\,h}{s} \times \frac{(S-s)^2}{s}$$

and that divided by the depth of penetration will give the average pressure—

$$\frac{W\,h}{s} \times \left(\frac{S-s}{s}\right)^2$$

or in our notation—

$$\text{I} = \frac{12\,W\,h}{s} \cdot \left(\frac{S-s}{s}\right)^2$$

The test of a pile at Royal Victoria Dock, London, is recorded in *Engineering*, December 29, 1899, p. 826, as follows:

Patch-pine pile, 12½ × 11½ = 143·75 sq. in., 37 ft. long = 36·8 cub. ft., at, say, 50 lb. per cub. ft. = 1,840 lb. Weight of ram = 12 cwt. = 2,016 lb.

Driven in peaty ground a distance of 36·1 ft., going 2¼ in. to four 8-ft. blows when driving was stopped.

Loaded with rolled joists balanced on head.

Load 10 tons	No sinking	Remained thus 24 hours.	
„ 20 „	1/16 in. „	„ „ 48 „	
„ 30 „	1/16 in. „	„ „ 0 „	
„ 37·5 „	1/16 in. „	„ „ 7 days.	
„ 56·9 „	¼ in. „	„ „ 4 weeks.	

No further sinking. Load being removed, pile rose 3/16 in.

The rising of the head of pile when the load was removed showed the amount of temporary compression in the timber, and the missing 1/16 in. may have been further compression held back for a time by the friction of the earth at the sides, and possibly reappearing some time later, a sort of *hysteresis*. The result of the test shows that the pile was practically safe with a load of 60 tons, but, like other tests that stop short of completion, it did not show that it would have failed with double the load or more.

The sort of test that is required to prove the accu-

racy of any formula is to measure the distance moved by the head and by the point during, say, the last four blows, and take the average for each. Cut off a foot from the top of the pile to receive the load on a good surface. Carefully level through from a fixed bench mark to find the level of the top of unloaded piles. Calculate the safe load on the pile and load it up until the head of the pile has sunk to the amount to which it was previously compressed (*i.e.*, previous average movement of head—average movement of point); note this load. Then continue loading, and note level of pile at each ton addition until the head of the pile has sunk, say, double the previous compression (*i.e.*, previous average movement of head, minus average movement of point. Then leave it loaded for twenty-four hours, and note whether it has sunk further and how much. Remove the load and note the result.

The difficulties in the way are—

(*a*) Finding enough load.
(*b*) Supporting the load on the pile without friction.
(*c*) Measuring the results accurately.
(*d*) Avoiding personal danger throughout the test.

REINFORCED CONCRETE PILES.

The advantages of reinforced concrete piles are so manifest that they need no express recommendation here. The chief physical differences from timber piles, as regards driving and their supporting power, are due to their extra weight and their friable nature. They should be made with slow-setting cement six weeks before driving, but if made with quick-setting cement they must be left eight weeks, because in the latter case the outside hardens first and leaves the interior soft. They should be driven by steam or drop hammer with a 3-ton ram, having a fall of 3 ft., with a steel helmet filled with sawdust, and preferably without a dolly.

In America the use of a water jet is found to greatly facilitate the sinking of concrete piles.

Hollow cylindrical reinforced concrete piles have been used at Southampton, Newcastle-on-Tyne, and Liverpool. They are lighter and cheaper than solid piles and more effective. Those at Brockelbank Dock, Liverpool, were 20-in. diameter. Reinforced concrete piles of circular section are easier to drive than square piles, and as they have no sharp angles are less liable to be damaged by coming into contact with boulders, &c.

As reinforced concrete piles are made horizontally, care must be taken in lifting them; the points of attachment for lifting should not be less than half the length apart, and if lifted with one end on the ground the attachment should be one-third the length from the other end.

The reinforcement rods (about 2½ per cent) should preferably be hooked at the top and electrically welded together at the bottom. They should be bound helically by, say, ¼-in. wire, 4-in. pitch, carefully secured at the top.

The Nasmyth steam pile-driver, quoted by McAlpine (Minutes of "Proceedings" of the Institution of Civil Engineers, xxvii., p. 277), with a ram of 3 tons and a stroke or fall of 3 ft., gave from sixty to eighty blows per minute. Although the force of the blow was much less the effect was much greater than with ordinary pile-drivers, and the piles (timber) were capable of being driven to a greater depth. This was no doubt due to the earth not having time to settle round and adhere to the piles.

It is a debatable question whether reinforced concrete piles are more easily and economically driven to the required depth by a drop hammer or by a steam hammer. The probability is that upon a trial with equal weights of hammer the advantage of the steam pile-driver in the case of wooden piles would be maintained with reinforced concrete piles.

The building laws of most of the cities in the United States allow on concrete piles a safe load from 350 to 500 lb. per square inch on the concrete, plus from 6,000 to 7,500 lb. per square inch on the vertical reinforcement. This is irrespective of the nature of the soil or depth driven, but they are supposed to be proportioned according to the Wellington or *Engineering News* formula.

It is a commonly received notion that a reinforced concrete pile will safely carry double the load that a timber pile of similar dimensions would do, but the writer has not found any data from which such a conclusion could be absolutely derived. He has not found a single case of a test load which has caused a concrete pile to sink further. There are many accounts of loads put on piles which did not cause any sinking, but these have no practical value for checking the formulæ.

SCREW PILES.

Screw piles of reinforced concrete have been patented by Mr. Vernon Inkpen, of Portsmouth, and they would probably be found very useful in a peaty or wet sand foundation.

Rankine's "Useful Rules and Tables" say: "The load supported by a screw pile in practice ranges from three to seven times the weight of earth which lies directly above the screw blade." This seems to be a very peculiar way to measure the supporting power, and appears to be based upon the resistance to the "spewing-up" effect of the downward pressure by the screw blade, and not on the direct resistance of the soil below the blade to compression. The fact is that the soils vary so much between the extremes of plastic clay and firm gravel that, whatever rules may be laid down, personal judgment must come in as the most important factor, whatever kind of pile or method of driving may be employed.

REFUSE COLLECTION ECONOMIES.

ELECTRIC VEHICLES FOR SURBITON.

At a recent special meeting of Surbiton Urban District Council consideration was given to a report and recommendation from the Sanitary Committee with regard to the proposed purchase of two electrically propelled dust vans.

The report stated that the cost, under contract, of the removal of house refuse in the district for the current year was estimated to amount to £1,458, an increase of nearly £400 on the year 1914-15, and owing to the uncertain conditions which prevailed, in consequence of the war, no doubt the contract price for the ensuing year would be higher than ever, if, indeed, any contractor could be found willing to enter into a twelve months' agreement. Moreover, the present system of dust collection was in need of improvement. After much consideration the committee recommended the council to purchase two electrically propelled dust vans from Edison Accumulators, Limited, at a cost of £1,025 each. The company had intimated that they would be prepared to accept payment of £500 down, and the balance by instalments spread over three years, with interest at 6 per cent per annum. The committee added that they had had the advantage of the advice of Sir John Snell on the matter. With two vehicles and five fillers the whole of the house refuse in the district could be collected once a week, and after the vehicles were purchased, at the end of three years, the cost of the dust collection would be about £530 per annum less than the cost of doing the work by the present system, assuming the contract price next year, and in the succeeding years, to be 10 per cent more than it is now. In addition, the council would have purchased the two vehicles outright, and would have a depreciation fund at the bank amounting to nearly £600.

The recommendation of the committee was adopted.

PRE-WAR BUILDING CONTRACTS.

COVERNMENT PROMISE OF "EARLY CONSIDERATION."

In the House of Commons Mr. Peto asked the Prime Minister whether he was aware that the question of hardship arising out of the state of war in connection with building contracts entered into before the war had been brought to the notice of the late Prime Minister and a draft Bill submitted, and that consideration had been promised; and whether he would undertake that this matter, in view of its importance to one of the largest industries of the country, should not be overlooked, and, considering its daily increasing urgency, would receive consideration at an early date.

Sir G. Cave, who replied, said the answer to the first part of the question was in the affirmative, and the matter would receive consideration at an early date.

Derby Electricity Expenditure.—The Derby Corporation electricity plant, although worked at its greatest capacity, is unable to keep pace with the demand for current for power purposes, which has increased enormously during the war. The committee have now decided to ask for sanction to a further capital expenditure of £30,000 on buildings and machinery.

Housing and Town Planning after the War.*

By Councillor HARRISON BARROW, Chairman of the Birmingham Tramways Committee.

I wish, in the first place, to emphasise the obvious requirements and features in the present situation and in what *will* be the situation when the war is over.

(1) That we must not waste money and lives in the future by allowing our great cities to grow in the haphazard and casual way in which they are now growing.

We cannot afford the loss of time caused by the congestion of our narrow roads, and the inefficient means of communication; and the men returning from the trenches will not consent to live in the slums, or in rows of houses crowded together.

(2) The second point is, that the war has shown our mean stupidity in not spending more money on housing and town planning. No other expenditure would produce more abundant return than this; yet in the past the Government and local authorities have doled out money in a few paltry millions, and we have been told that it was impossible to find more, that the nation could not afford it.

It is important to realise the serious shortage of houses. Mr. Harold Shawcross tells us that the average number of houses required every year is 100,000; during the past two years the number built has been negligible—call it 10,000 or 20,000, they do not count.

Before the war began there was a shortage of houses; therefore, if the war ends in a few months' time, we shall require at least 300,000 houses, and, in addition, there are 600,000 houses not fit for human habitation which ought to be pulled down.

Three hundred thousand houses at ten to the acre would cover 30,000 acres, or 50 square miles, and if the 600,000 insanitary houses were destroyed and replaced, 150 square miles would be covered. It is essential that these square miles should be laid out on town planning lines.

COMPULSORY TOWN PLANNING.

I have read the report of the Urban Land Inquiry Committee and the papers of Mr. Aldridge and Mr. Shawcross thereon. The suggestions made are of the nature of compulsory town planning. I consider that compulsory town planning is essential, but my impression of their suggestions is that they are too elaborate, and that they will hold up building indefinitely.

It has been well said that the first essential of any scheme is the planning out of the main roads, but, from experience of town planning in Birmingham, I know that it is impossible to decide on the main roads without very great consideration and a long period of negotiation and conference, and I doubt if it is possible satisfactorily to decide the main roads of a suburb under a period of one to two years, and then only if there are members on the local authority who will push forward the project with energy and ability.

On the other hand, it is possible, in a comparatively short time, to decide on the number of houses to be built per acre on different zones; I propose, therefore, that every town and urban district should be instructed to prepare maps, showing three zones. (Compulsion of some kind would have to be applied by Parliament through the Local Government Board.)

(*a*) The areas which have been developed for building purposes, where the roads have been constructed, and the land completely laid out for building purposes.

(*b*) Areas where the land has been partially laid out for building purposes, with roads laid out and partially constructed.

(*c*) Areas where the land has not been developed for building purposes.

The Local Government Board would examine the plans, and give a final decision as to the areas of these zones, and the following maximum densities of building would be allowed in the various districts.

(*a*) On this area not more than eighteen houses to the acre would be allowed.

(*b*) Fifteen to the acre.

(*c*) Twelve to the acre.

I am basing these figures and this proposed arrangement on that followed in the East Birmingham town plan, which was for the development of a manufacturing side of the city where there is great variety in the character of the buildings.

The proposals were objected to by one agent, but otherwise met with general approval.

It will be urged that twelve is too high a figure for a minimum, but Birmingham experience shows that, if less than this figure is fixed, it is only with the general consent of the landlords in the district, and I think owners of land where larger houses are being built are generally capable of looking after their own interests, and there will be nothing in the regulations to prevent the number of houses being still further restricted.

To meet this view, however, a general instruction should be given that in all these zones regard should be had to the density of houses in the neighbourhood, and, where the density in the neighbourhood is less than twelve, the land owners should be consulted and an endeavour made to arrive at an agreement with them for a lower number.

I quite realise that complications will arise as to the definition of a house and as to the building of factories, flats, shops, &c., also how the acre is to be measured, &c.

Taking the last point first, I would suggest the adoption of Clause 17 A, B 1 and 2 in the North Yardley scheme:—

> 17A.—In this clause dwelling-houses shall mean houses other than flats designed for private occupation only by not more than one family, together with such outbuildings as are reasonably required to be used or engaged therewith. Any other buildings are in this scheme referred to as "special buildings."
>
> B1.—For the purpose of reckoning the number of dwelling-houses to an acre that may be erected in their district, the authority shall include in the measurement of the acre a depth of 7 yds. along the frontage of the land in question where it abuts on any road, or roads, whether private roads or highways, repairable by the inhabitants at large, or half the width of the road, whichever is the least, and may also include the whole or any part of any public open space acquired by the authority by gift from the owner of the land in question.

I would also adopt—

> 17A II.—Subject to the provisions of this clause, an acre shall be measured so as to include such land as the authority in each case, having regard to all the circumstances, determine by order to be made under sub-clause C II. of this scheme.
>
> C II. is regulation as to "building land."
>
> 17C I.—Not more than twenty houses on any one acre, and no dwelling-house shall be built, save with the consent of the local authority, with a less quantity of land as to its site and curtilage than 242 sq. yds.
>
> 17 IV. A.—Special buildings.

BUILDING LINES.

Further, I would propose that in the A and B zones the building line shall not be less than 30 ft. from the centre of the road, and in the C zone not less than 36 ft.

The East Birmingham scheme clause reads:—

> 7C.—The corporation may determine the building line when any plan for any building in such a street is submitted to them for approval, provided that such building line shall not be less than 36 ft., or, except by agreement, more than 41 ft. from the centre of the road.

I should have proposed a universal distance of 36 ft. if it had not been for the suggestion in the Urban Land Inquiry that the distance between houses on opposite sides of a road should be only 50 ft., which I cannot understand. With an ordinary 42-ft. road it only means that the building line is set back 4 ft. on each side. It may be urged that 72 ft. is too wide for a street of shops; if a street is a shopping street it must be fairly important, and probably 72 ft. is not too wide, but I suggest later on the possibility of local authorities having discretionary powers as to the building line in the case of shops, factories, &c.

BREAKS IN BUILDINGS.

There are other clauses in the East Birmingham and

* From a paper read at the last meeting of the Town Planning Institute.

North Yardley plan which might be universally adopted. For instance (I ought to explain that the North Yardley clauses have not yet been approved by the Local Government Board):—

Breaks in buildings. 18. North Yardley—

Without the sanction of the authority not more than eight buildings shall, in any place, be built under one continuous roof, or without an interval of at least 6 ft. in width, such interval to continue throughout the whole height and depth of the building. Provided that the authority may, if they think fit, allow a block of not more than five dwelling-houses, which expression shall include a single dwelling-house, or a pair of dwelling-houses, to be built with an interval of less than 4 ft. in width. No part of any continuous block of more dwelling-houses than four shall be built nearer to the owner's boundary than 3 ft., except when such boundary abuts upon land not built upon, or not likely to be built upon, and when the written consent of the authority in question has first been obtained.

Clause 18 in the East Birmingham scheme is similar, but the North Yardley clause obviates several difficulties.

If it is possible, discretionary powers might be given, such as in North Yardley, 7 D, for building lines for shops, factories, and falling sites, or for architectural effect, as in North Yardley 7 C.

The Local Government Board objects to giving discretion to local authorities, but I see no reason for its objection, especially if it could be confined to towns of, say, 50,000 inhabitants.

In any case, the architectural clause should be inserted:—

7C N.Y. The authorities may sanction the erection of a group of buildings which, for the production of an architectural effect, shows the frontage of such building partly in front and partly behind the building line, provided that the frontage is not at any point more than 5 ft. in front of the building line, and the portion of the frontage behind the building line is so designed as to give an unbuilt area at least equivalent to that taken by the portion of the buildings in front of the building line.

I am extremely anxious to keep this preliminary scheme as simple as possible, and am therefore a little afraid of any addition liable to complicate it, but I see no reason why arrangements should not be made for securing land for widening the most important main roads.

ROAD WIDENINGS.

I therefore propose that towns should be encouraged (I do not think that compulsion could be applied in this case) to include in their preliminary scheme plans for the widening of all main radial roads which are now, or obviously will be, required in the near future for tramway purposes or for omnibus routes.

This would not apply to roads the frontages to which are fully built up.

Such scheme of widening to merely secure in the future sufficient land to enable the roads to be widened (to at least 80 ft.), and not to necessitate any expenditure on the carrying out of any works until they are actually required.

Of course, I cannot attempt in such a paper as this to cover all the details which would have to be considered. If the Institute think anything of them, a committee would have to be formed to consult with the Local Government Board and to frame a Bill.

If these suggestions were adopted, we should mark an immense advance in all non-planned districts; the number of houses to the acre would be only twelve in the undeveloped areas, and the space between the fronts of houses would be 72 ft.

They are not suggested as in any way taking the place of a complete plan—quite the reverse; every effort must be made to urge local authorities to plan all their main roads at the earliest possible date, to decide their manufacturing areas, their residential districts, &c., when the main roads are planned and the arrangements for contributions from the landowners are completed; then it will be possible to arrange for roads with a narrow macadamised portion, such as those shown in the B sheet of the East Birmingham plan.

ARTERIAL ROADS.

Mr. Walter Long said on October 31st, in reply to the deputation representing the conferences of local authorities which have been held to formulate schemes for the construction of arterial roads in Greater London, that he should consider it his duty to advise the Government that their first call upon public funds ought to be for the provision of housing of our people, and for sanitation and water supply.

I submit that the proposals I have made will not entail any expenditure, or very trifling, and that it would be a great misfortune if the large number of houses required to be built after the war were allowed to be erected without some restrictions as to their density and position.

Mr. Walter Long's reply in regard to the arterial roads in London was not absolutely negative, and he did promise to endeavour to preserve the suggested routes from further obstructive buildings, and said that Sir George Gibb (head of the Road Board) should consider the proposals.

The work of the conferences has occupied, I believe, about three years, and this fact shows what care and consideration is necessary before any such scheme can be evolved.

I would therefore most strongly urge that a similar series of conferences should be held in the provinces, even now in war time, to consider the main arterial roads.

Mr. Patrick Geddes, in the book which I have already mentioned, "Cities in Evolution," suggests that for the question of main roads the country should be divided into seven areas, to be called:—

(1) Lanceston—Liverpool, Manchester, &c.
(2) West Riding—Halifax, Bradford, Leeds.
(3) South Riding—Sheffield.
(4) Midlandon—Birmingham, Coventry, Kid. &c.
(5) Waleston—South Wales.
(6) Tyne—Wear and Tees.
(7) Greater London.

I understand that as regards No. 7, much of the preliminary work has been done, and as regards 1 and 6 a good deal of work is being done. The representatives of these three districts deserve great credit for their pioneer work.

It ought not to require a large number of local representatives to attend such conferences, and it should be possible, now that estate development is at a standstill, to find a competent surveyor to assist in each area with, of course, a staff of assistants under him.

As a matter of fact I understand that the Civic Survey Committee of the Royal Institute of British Architects have a number of architects, &c., over military age, who are skilled in this work and whose services should be made use of

INTER-COMMUNICATION FACILITIES.

As chairman of the Birmingham Tramways Committee, I am particularly interested in the possibilities of the extension of tramways and light railways for inter-communication between towns and districts—not only for passenger traffic, but also for goods.

The success of such schemes depends largely upon securing wide roads and laying the tram rails on sleeper track by the side (or in the middle) of the road. The saving of paving between the tracks is about £3,000 per mile, and the cost of the land required at £100 per acre would only be £300.

In addition, there would be saving in the cost of maintenance, and the running expenses would be lessened on account of the greater speed at which cars would be run.

I mentfon this to show the importance of wide roads connecting centres of population. The tramways and light railways would also traverse country areas, and much might be done in carrying vegetables and fruit, &c., into the towns and carrying out manure, &c., to the country districts.

In Birmingham, on our ordinary tramway system, the department is carrying about 80,000 tons per annum at a pre-war cost of 2¼d. per ton per mile.

There is a theory in some quarters that towns should not run trams outside their borders, as they are thereby developing roads not in their own areas.

This is a false view to take, as the more efficient inter-communication makes for progress, and the most profitable arrangement, from a rating point of view, would be to have all the factories in a town, and all the houses of the workpeople outside, but whether the particular town benefits or not does not matter. We have had too much of such parochial selfishness; we must do that which is best for the nation as a whole.

The question has been raised as to who should pay for this extra width required for tramway purposes. I think that it is clear that the tramway authority should pay for this, and it will probably be necessary to have a joint committee representing various local

authorities to work the tramways connecting several towns. This question, however, does not come within the limits of this paper, but requires to be mentioned to complete the proposal.

HOUSING.

My last consideration is that of housing.

It seems unlikely that builders will be anxious to erect houses after the war is over. The fact that rents have not been raised, and that new houses will have to be let at a much higher rent, if they are to pay, will not conduce to building.

Nevertheless, the houses must be built if we are to develop a healthy race and raise the general standard of civilisation.

A special committee was appointed three years ago to inquire into the housing conditions of Birmingham. This committee recommended the city council to develop estates in the suburbs, that is, to make the roads, lay sewers, &c., and then let the developed estates to builders at a figure to cover interest and sinking fund.

The idea of this suggestion was that the builders would be saved having to invest large capital sums in laying out estates. Owing to the war nothing has been done in carrying out this proposal.

Sir W. H. Lever has suggested that the municipalities should go further, namely, that they should develop estates and then hand them over, free of cost, to builders.

Apparently, there is to be no guarantee that the tenants are to profit by the gift, which the landlords will be able to appropriate, and charge the tenants with the full commercial value of the house, land, roads, and other costs of development.

With all respect to Sir W. H. Lever, the proposal is absurd. There is no object in making gifts to landlords in this fashion. Surely, if the town is in such straits to get houses built, the proper course would be for the municipality to build its own houses, and get the benefit of the land and development values. We all know what has been done in Germany as to purchasing land in the suburbs of their towns, and then running out tramways to them, so as to increase the value of the land. If the cities here were to follow this example, then develop the land as suggested and sell to holders, or to co-partnership societies, building societies, &c., much progress might be made. The municipality might further advance a considerable proportion of the cost of the houses to the societies. If it is impossible to obtain houses by these means, the municipality must build itself, and there is no reason why it should not do so successfully.

Municipal housing schemes have usually been to accommodate the poorest people in the centre of our towns, an impossible proposition on an economic basis.

I hope municipalities will not attempt such schemes in future, but provide accommodation for the artisans in the suburbs, in good houses built on town-planned estates—that is, if private enterprise does not find the accommodation required.

There are plenty of slums and cheap houses in the centre of our large cities, and what is required is not such houses, but good houses in the suburban areas.

Wages must be raised, or kept up to their present standard, to enable the working man to live in houses of such a character and pay a sufficient rent to cover all cost to the municipality.

Institution of Sanitary Engineers.—A meeting of this body will be held on Wednesday next, the 3rd inst., when the presidential address will be delivered. The retiring president, Mr. A. P. I. Cotterell, will take the chair at 7.30 p.m.

The Decimal System.—Questioned as to the intentions of the Government respecting the proposed adoption of the decimal system of coinage, weights and measures, Mr. Bonar Law stated the other day that he could not hold out any prospect of early legislation dealing with the subject.

Town Allotments.—Replying to a question in the House of Commons, the Parliamentary Secretary to the Board of Agriculture stated that no figures were available as to the number of town allotments in private ownership, but on December 31, 1914, the area of allotments provided by urban local authorities in England and Wales was 4,627 acres, which were let to 78,569 individual tenants and forty-seven allotment associations. The average size of the allotments was rather less than 10 rods.

HOUSING THE MUNITION WORKER.

HOW ACCOMMODATION IS PROVIDED.

One of the most urgent problems which the Ministry of Munitions has to solve is the housing of the munition worker. The opening of a new factory, or the conversion of existing works to the needs of the State, often involves the transference of large numbers of workers to localities which at most can meet the requirements of a normal population, and even to localities where there is an actual shortage of houses. The immediate remedy is found in the provision of temporary accommodation; but in other cases permanent buildings are erected, the latter method being followed especially where house famine is known to have existed in pre-war days and where there are good prospects of permanent manufacturing activity.

The methods adopted by the State for the provision of permanent accommodation vary according to local circumstances. In certain cases loans are made to public utility societies which undertake the housing of munition workers, such loans being conditioned after the manner familiarised to the public by garden suburb and other associations. In other circumstances loans have been made directly to certain individual firms. These loans have been issued at the current rate of interest usually 5 per cent and run, generally speaking, for a period of forty years. Certain private firms—now controlled establishments—have, moreover, been permitted to charge some portion of the increase on the cost of building due to war conditions to that part of the firm's profits which would otherwise have gone to the Exchequer. Such an arrangement is, however, only made in exceptional cases. A contribution of a part of the capital cost of building is in other instances made by the State to certain local authorities. In all cases this contribution is less than the estimated increase due to war conditions.

TYPE OF COTTAGE PROVIDED.

The type of permanent building erected by these varying methods is similar, and is that which characterises our newer industrial areas—*i.e.*, a two-storey brick cottage, containing two or three bedrooms, a living-room, a kitchen, and a bath. In Scotland a permanent dwelling of more limited accommodation is often provided.

Far more variety in construction has been found possible in the provision of temporary accommodation, and, excluding the adaptation of existing buildings, three distinct types of provisional accommodation have made their appearance — temporary cottages, hostels, and hutments, or groups of hostels. In two cases, moreover, the Ministry of Munitions has been obliged to provide temporary villages with their own schools, churches, hospitals, shops, and institutions. One of these munition villages is peopled almost entirely by Belgians. The temporary cottages for the use of munition employees correspond fairly closely with the usual type of permanent cottage, save that the former are built of wood or concrete instead of brick, and are usually one storey instead of two. They contain from three to five rooms, and are generally rented on the basis of from 6s. 6d. to 7s. 6d. a week for a three-roomed cottage.

The hostel is usually designed to house about thirty persons, although larger erections have been made where the demand for the housing of girl workers has been pressing. It is provided with its own kitchen, dining-room, and common-room, and to a certain extent life therein approximates to that of a large family.

The hutment or colony system, where several hostels are grouped, is found particularly convenient where a large number of women workers must be accommodated. Each hostel is designed for the sleeping accommodation of from 100 to 130 persons, the dormitories being divided into cubicles, some single, some double. Adequate accommodation for bath-rooms, &c., is always made in these dormitory blocks. Under this colony system, however, meals are usually partaken of in separate buildings, where the residents from all the hostels meet in the dining and recreation rooms. An administrative block is also erected, where the offices and rooms of the lady superintendent, matrons, and staff dispensary and invalids are located. All the buildings are heated by hot-water pipes, and are lit by electric light or gas.

White Jackets for Street Workers.—The night workmen of Westminster City Council are to wear white jackets to make them more conspicuous in the darkened streets.

WAR BONUSES.

METROPOLITAN WATER BOARD COMMITTEE'S PROPOSALS.

At their meeting on Friday last the Metropolitan Water Board had before them a report of their General Purposes Committee on the subject of war bonuses.

The committee reminded the board that in March, 1915, they granted a war bonus to workmen on the permanent and temporary staffs of the engineer's department, and afterwards extended it to the wage earners in other departments. No war bonus had been granted to any part of the clerical staff. In April, 1915, and again in October of the present year, the committee received letters from the Board's Staff Association placing before them the claims of the clerical staff to consideration in the matter. They found that of the board's own constituent authorities, at least thirty had granted a war bonus to officers, and in eighteen of these cases the bonus was given a year or more ago. They also found that a considerable number of other influential bodies, in or near the Metropolis, had taken a similar course. The committee went on to point out that the Government's Departmental Committee on Prices in their interim report urged upon all employers and public bodies the desirability of reviewing their pay roll and of taking steps to improve the position of those who had not sufficiently benefited by the general upward movement. It appeared also from the official statistics of the Board of Trade that the average percentage increase in the cost of food in the large towns in the United Kingdom amounted since the outbreak of the war to not less than 81 per cent.

In view of these circumstances and the precedents mentioned above, the committee were of opinion that the time had arrived when a bonus should be granted to the less highly paid divisions of the board's clerical staff.

The committee suggested that, if the board agreed in this view, it would be well to avoid any basis which must of necessity involve a considerable amount of bookkeeping and the periodical revision of records, such, for instance, as would arise from an attempt to regulate the bonus to the married man according to the number of dependents from time to time. A more simple method would be to grant the bonus by way of a percentage increase of salary, care being taken to make a distinction between men with and without dependents, but, inasmuch as the percentage rate would probably diminish as the amount of salary increased, inequalities in bonus would result from the arbitrary change in the rate per cent. These defects would be avoided if the war bonus were based upon the increments of salary pertaining to the different classes of clerks according to the scales already approved by the board, and after careful examination of the subject this is the method which the committee recommended for adoption. In other words, their proposal was that each permanent clerk up to a prescribed limit of salary should receive by way of war bonus temporary additional pay per annum equal to half a year's scale increment of salary, or equal to a full year's increment if married or certified to be supporting dependents.

It was essential, the committee observed, that there should be uniformity of method in dealing with applications for full bonus on the ground that there were dependents. Such uniformity could scarcely be expected if the work of certification were left to a number of individuals, for instance, to each chief officer acting for his own department. It was felt that it would be wise to co-ordinate this part of the scheme by leaving the work of certification to the clerk of the board and the accountant acting together for the whole staff.

As the original application from the Staff Association was received so long as twenty months ago, and having regard to the fact that in the case of so many other bodies the bonus had been enjoyed for a considerable period, the committee suggested that in the present instance it might date back to October 1, 1916, when the additional bonus to the workmen was granted.

Extraordinary Traffic. — At Bloomsbury County Court, Judge Bray has awarded the Calne, Wiltshire, Rural District Council £75 for damage done to certain of their roads by a motor lorry, the property of the Dairy Supply Company, passing over such roads, and constituting extraordinary traffic.

NOTES FROM IRELAND.

Specially Contributed by an Irish Correspondent.

[In the hope of making these notes as practically useful as possible the writer invites readers to favour him with communications thereon from time to time. They might be constructively critical, or helpfully supplementary, might indicate new points upon which information is desired, or might merely convey information. Communications will reach the writer if addressed "Irish Notes," 24 Bride-lane, Fleet-street, E.C.]

Need for a Testing House. During the past ten years or so there appears to have been a very great improvement in the quality of the cement imported into Ireland, and probably the bulk of it is now up to the standard specification. No doubt in many cases, when cement is not found up to standard, the fault is due to improper storage, or to the tests having been made by unskilled persons. A testing house is very much required in the country, where tests not only of cement and similar materials could be made, but also of steel, iron, road materials, and a vast number of other articles, both raw and manufactured.

* * * *

Take road material, for instance—at present surveyors have no doubt, from long practical experience, more or less knowledge of the various materials used for road maintenance purposes, but it would be a great advantage, and of much interest to all concerned in road and street maintenance if the stones and other materials used for maintenance purposes could be classified, tested, and samples then be exhibited at a testing house, each sample with its proper nomenclature, its percentage of loss when tested, and results of any other tests that may have been made of it in order to determine its relative value compared with other samples. If one of the universities or principal technical schools in the country would arrange for the testing of materials, classification of stones, &c., for a small fee for each sample submitted, the institution would derive some additional revenue and credit, while the students would be benefited, and engineers, manufacturers and others would be saved much trouble in having the materials they use tested and their values, to some extent at least, determined.

* * * *

Damage by Traction Engines. The decree given for £140 for damage caused by a traction engine travelling over the public road from Cloncurry Bridge to Enfield, in co. Meath, seems at first sight rather heavy, but probably the expense of making up the road by the Meath County Council will come to a good deal more than the amount of the decree. If owners of traction engines took a little more care when travelling over weak roads, and took off their engines when they found they were causing excessive damage they would receive more toleration from county councils.

* * * *

Until the Act of 1911 dealing with traction-engine traffic was passed owners of such engines were seldom proceeded against, and many owners were no doubt under the impression that they could travel over the roads as they pleased, regardless of the damage they caused. Some decrees given recently have, however, disillusioned them on this point, and some owners now avoid taking out their engines during the winter months, except when they are using them for driving threshing machines, or for a similar purpose. In one instance at least a traction engine owner has agreed with a council not to take out his engine for hauling purposes during the winter months on the understanding that no action will be taken against him for damage caused to roads during the summer. This seems an equitable enough arrangement, the damage to fairly strong roads during the summer months by moderate traction-engine traffic being comparatively small as compared with that caused during winter. In the case of weak roads an engine may, of course, break through the crust at any time, but this is far more likely to happen in winter, when both crust and subsoil are saturated with water.

* * * *

It is, of course, often argued that county councils should construct and maintain roads in their charge in a condition to accommodate all forms of traffic, but many Irish roads are so weak that it would be impossible, except at enormous cost, to strengthen them sufficiently to carry heavy motor traffic in winter

The Surveyor

And Municipal and County Engineer.

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without serious injury to them. If traction-engine traffic has to be conducted over such roads it is therefore in the interests of the ratepayers that such traffic should only be carried on in the summer months.

* * * *

Some Irish main roads are also beginning to suffer severely from the traffic of heavy motor vans over them, and this form of traffic has increased to such an extent on certain roads that it has been found necessary to supersede the ordinary macadam by improved methods of construction. Experimental lengths of different materials have been laid down in different counties with varying results. Probably the simplest and cheapest way of providing for this traffic at the present time is by laying a strip of tar-macadam or Rocmac about 10 ft. wide down the centre of a road.

CORRESPONDENCE.

Εἰς ἀνὴρ οὐ πάντ' ὁρᾷ

(One man does not see everything.)

—EURIPIDES.

THE DESIGN AND COST OF RESERVOIRS.

To the Editor of THE SURVEYOR.

Sir,—With regard to Mr. Binnie's paper on the Cross Hill covered service reservoir, read before the Institution of Water Engineers, the writer having been engaged on the design and building of such reservoirs of considerable size for over twenty years, and being familiar with the neighbourhood of the work, has been looking forward to such a paper for some time, partly owing to the unusual capacity and partly owing to its being a scheme carried through Parliament by the lamented J. F. Deacon, for whose work he has always had the highest admiration.

Unfortunately, as is usual with large works, the discussion was chiefly complimentary.

It is somewhat remarkable that the engineers of the work, having previously constructed only small covered service reservoirs because their practice has not demanded large reservoirs of this class, should have adopted such an elaborate and somewhat unusual design. One of the speakers suggested that the roof had an ecclesiastical character. Now, if this were a cathedral the novelty of the design might justify its adoption (even if it cost a little more), but as this is a structure seen only by a few labourers once in a dozen years when cleaning is required, true economy should surely be the dominating feature.

This is obviously not a case where roofing is imperative, but the resident engineer (if correctly reported) apparently suggested that, with roofing of the type used, it was cheaper to make a covered reservoir than an uncovered reservoir. Such a suggestion appears quite untenable, and Mr. Priestley was on quite sound ground when he said that roofing adds about 50 per cent to the cost. To illustrate this point the writer would say that he has seen an estimate made a few years ago by a well-known firm for a very large uncovered reservoir on a hard-rock site to cost £1,900 per 1,000,000 gallons.

Most of the speakers seemed content to remark that the cost per 1,000,000 gallons capacity was low. It is certainly not excessive, but the writer hopes to show that it might be lower. Little stress was laid on the important factor of size; a curve representing the cost per 1,000,000 gallons of covered service reservoirs would be steepish for the lower capacities, and gradually flatten as the capacities rose till it became practically parallel to the base line. In any case, Mr. Binnie's apparent contention that by his novel construction he effects an economy in the ratio of 5,000 to 2,800 is far too good to be true. It is quite true that the Honor Oak reservoir, containing over 50,000,000 gallons, cost nearly £5,000 per 1,000,000 gallons, but that reservoir is really three separate reservoirs; it is constructed in heavy clay in an expensive district, and special difficulties were met with in making it.

On the other hand, the Cross Hill service reservoir is on an ideal site, the foundation being at this spot on the new red sandstone, a firm, but easily excavated material. When compacted and watered in thin layers this material undoubtedly produces very little pressure behind a wall.

The writer is of opinion that an equally efficient and durable reservoir could be constructed on this site—of the usual circular form with mass concrete walls, monolithic concrete piers supporting main and secondary beams of reinforced concrete, and a reinforced concrete slab carrying about 1 ft. of earthwork. He has worked out an estimate of such a reservoir, and believes it could have been constructed in 1913-14 for £69,000, and possibly somewhat less. [It may be, however, that Mr. Binnie does not favour ordinary reinforced concrete construction.]

ESTIMATE FOR COVERED SERVICE RESERVOIR
(water depth, 29 ft.; gross capacity, 29,000,000 gallons).

	c.y	£
Excavation and banking	100,000 at 2s.	10,000
Extra for soiling		600
Concrete floor, 1 ft. thick	6,300 at 22s.	6,930
Concrete in walls	15,200 at 25s.	19,000
Asphalt on floor	19,000 at 2s. 6d.	2,375
Do. walls	5,000 at 1s.	1,000
Roofing (from actual cost of a recently completed structure)		23,000
Roof drainage and embankment drainage		1,000
Inlet, outlet and by-pass piping, and chambers in enclosure		3,000
Washout pipe		700
Fencing and gates		1,200
Sundries		1,595
		£69,000

Assuming a nett capacity of 28,000,000 gallons, the rate per 1,000,000 gallons is £2,465. [All figures relate to imperial gallons.]

The resident engineer gives the actual cost at £2,625 (apparently without piping).

The writer has diligently studied waterworks practice in America, where recently many large covered filtered water reservoirs with groined concrete roofs have been built, but it is difficult to get the costs of the reservoirs separated from other items. A few years ago fully detailed estimates for a 730,000,000 gallons covered service reservoir were prepared for New York Waterworks by a very large staff working under the direction of the very experienced engineers, Rudolph Hering and George W. Fuller. The estimate worked out at £1,600 per 1,000,000 gallons. An estimate made a few years ago by a commission of prominent American engineers for a 130,000,000 gallon covered service reservoir for Toronto amounted to £1,888 per 1,000,000 gallons. The largest *single* covered service reservoir in existence is probably that at Pittsburgh, 37,500,000 gallons, completed in 1908 at a cost of £2,560 per 1,000,000 gallons, which would have been reduced if the reservoir had been circular. The writer believes that, taken all over, prices in America are slightly higher than in Britain.

Unfortunately, the cost of the Ambergate reservoir (completed about six years ago), 25,000,000 gallons, has not been published [perhaps Mr. Sandeman will oblige with this], but a dozen years ago, a few miles from Cross Hill, there was constructed a 10,000,000 gallons reservoir at St. Helens in very hard red sandstone, at a cost of £2,600 per 1,000,000 gallons. This in an unusually substantial reservoir—in fact, it was made far too strong in deference to the Local Government Board. With a greater water depth and greater span of arches the cost should not have exceeded £2,200 per 1,000,000 gallons.

A dozen years ago a 10,000,000 gallons reservoir at Hull cost under £3,000 per 1,000,000 gallons, and Mr.

Ashton Hill has given the cost of a 10,000,000 gallons reservoir constructed by him at South Staffordshire at £3,000 per 1,000,000 gallons.

The writer prefers to put the asphalt lining on the face (battered and slightly offsetted) of the concrete walls, as brickwork is expensive; the work goes quicker when the whole wall is of concrete, and there is danger of the asphalt being damaged by green brickwork being displaced, and by the spading of the concrete. In such a large and deep reservoir the walls will probably move slightly when water is turned in, and the asphalt may be damaged. Hence the advantage of its being exposed, where it can also be much better inspected during execution.

With an asphalt lining, surely the concrete in the floor and walls might have been made 8 to 1, as was the case at Frankley and Long Newton, which are very large and deep open service reservoirs, and cement has improved very much since they were made.

Would it not have been better to put expansion joints into the walls?

It seems a pity that the asphalt covering of the roof is not continuous, as, with such a slim roof and the possibility of cracks developing later, water-tightness cannot be ensured, and there is the danger of contamination by men and horses when the grass is being mowed. Yours, &c.,

WATER.

December 23, 1916.

SURVEYORS AND MILITARY SERVICE.

To the Editor of THE SURVEYOR.

SIR,—It has been rather interesting to read the different comments in various papers—THE SURVEYOR included—regarding the formation of the Road Corps for France, and the way in which public officials have been offering their services for it.

It is certainly rather amusing to know that "A Constant Reader"—who writes in your issue of the 15th inst.—is prepared to join his Majesty's Forces, with or without his council's permission, now there are some rather good jobs going. But why not before? Surely he is more indispensable at the present moment than he has been at any time, seeing all his staff has gone?

Is it not a fact that our roads in this country are getting into a very bad state, and that it needs all the special skill of the surveyors and engineers now in office to cope with the problem of maintenance, seeing there is a shortage of labour and materials? And will it not also be very detrimental to take away wholesale men and surveyors who are directly responsible to the public and their employers for their maintenance? Is it not reasonable to ask why the great number of surveyors who have already joined up and offered their services to their country, and who have now applied for posts in the new Road Corps, should not receive preference over those who have only now decided to chance their council's anger in joining up against their wish?

There are some road surveyors known to the writer, and not passed for general service, who are specially suitable; there are also others who are out in France doing their bit who should be recalled and used before those who have not already joined up.

If there are more officials applying for commissions than required, then give them the offer of good non-commissioned officers' jobs, the best to be had. Surely Brigadier-General Maybury, who is so well known to us all, will see that the best men are picked for the best jobs, and consider whether the county surveyor, main road district surveyor, and rural surveyor are not equally suitable and qualified for the work he requires as the borough surveyor and town surveyor, who are really not so much road surveyors as municipal engineers, and who are not accustomed to deal with the problem of country roads which have to carry heavy vehicular traffic—a problem not easy to solve in France, where the weight carried by the roads must be colossal, and where no doubt it will require all the genius of the surveyor to cope successfully with the extraordinary circumstances prevailing.

These few remarks are in reply to "A Constant Reader's" letter of the 15th inst., and are intended to enlighten him on the point that there are lots of qualified and trained surveyors in the ranks who, in the writer's opinion, should receive preference over those who have not already joined up.

Wishing the new corps every success.—Yours, &c.,

N.C.O.

December 19, 1916.

[This subject is dealt with in "Minutes of Proceedings."—Ed. THE SURVEYOR.]

THINGS ONE WOULD LIKE TO KNOW.

(Contributed.)

Is it a fact, as recently stated by the Lord Mayor of Dublin, that in the municipal workshops of that city no fewer than ninety-three men are employed, and that there is not work enough for half of them? If this is so, does it not seem rather curious that at this time of stress, when every able-bodied man is required to help his country, such a state of affairs should exist in "distressful" Ireland?

* * * *

Why should the farce of constituting the engineer who has designed and is executing works which are being carried out by a contractor the sole arbitrator in case of dispute be continued, when the Law Courts have invariably upset such a clause in a contract? What would the trades unions have to say to such a clause between employer and employee? Does it seem altogether fair for an engineer, who has to arbitrate constantly all through a contract, that he should be sole arbitrator at the end of a contract when disputes may arise between him, the arbitrator, and the contractor in his employment?

* * * *

Has not the Borough of Chelsea devised an excellent method of darkening the light from the street lamps by the application of a dark green paint to the lantern glasses? Does not this effect the desired purpose, and might not this method be adopted in other localities?

* * * *

Were not some of us who attended the de-tinning conference at Caxton Hall on the first day much interested and amused at the manner in which Mr. Morgan Jones manipulated the various specimens of tin which he showed? Would some of us have been altogether surprised if he had produced a rabbit out of a sardine box, or a bunch of flowers out of a tin plate? Was it not evident, however, that he knows his subject thoroughly, and were not all present much impressed with his enthusiasm?

* * * *

Is it not sincerely to be hoped that the result of the conference will be to stop the waste of valuable material which has hitherto prevailed with regard to this modern product of our dustbins, and that in future we shall not only prevent this waste, but also divert to other channels the profits which before the war were made by certain German firms who took advantage of our wasteful procedure?

* * * *

Were not the suggestions made by the Manchester and Salford Women Citizens' Association to the Cleansing Committee of the Manchester Corporation the other day extremely sensible and reasonable? Is it not to be hoped that the committee will see their way to comply with the requests, especially that which suggested the employment of women as street sweepers—an innovation which has been so successfully introduced in other towns and cities?

* * * *

Is it not a true saying that it is an ill wind that blows nobody any good? Was it not pleasant to read in THE SURVEYOR "Notes from Ireland" column on the 15th inst. that "over a great part of Ireland it is now found impossible to obtain contractors to tender for road maintenance work on anything like the old terms prevailing a few years ago, and many miles of roads are being placed each year in charge of the county surveyors"? Has not the system of employing contractors for road maintenance been abandoned in England for nearly half a century, and is it not to be hoped that, even when the war is over, Irish authorities will not revert to this obsolete practice?

* * * *

That explosives can be manufactured at our sewage works seems to that eminent scientist Dr. S. Rideal to be quite feasible. Does not his paper on this subject, reproduced in THE SURVEYOR of the 22nd inst., make us all ponder on the possibilities that exist in the valuable compounds present in sewage, and help us to realise what a terrible waste of this material now goes on?

Manchester Corporation Officials and a War Bonus.—At a meeting of officials of the Manchester Corporation last week, called to consider conditions of service as affected by the war, it was decided to ask the city council to grant a war bonus of 10s. per week to each official whose present salary is under £500 per annum.

War Economies in Lighting.*

By L. GASTER, Honorary Secretary of the Illuminating Engineering Society.

One of the most noteworthy and revolutionary changes made, largely with a view to saving in fuel, is the Summertime Act, generally known as "Daylight Saving Act," which came into force for the period from May 21st until October 1st in the present year. The effect on supply companies naturally varies much, according to the locality and the percentage of gas or electricity used respectively for lighting and fuel. In purely residential districts the diminution in output has been considerable. In Ealing, for example, it is stated to have been as much as 23 per cent, and other companies similarly affected have remarked that the Act ought to be termed the "Artificial Light Saving Act." According to some figures recently given by Mr. A. E. Mackenzie before the Manchester Local Section of the Institution of Electrical Engineers, the saving in the purely residential district of that city was 13 per cent, but in the industrial districts there has been, since the Act was passed, an actual increase of 8 per cent. Taking the entire field of supply, the saving is of the order of 1–1½ per cent only, but even this is estimated to have led to an economy, in Manchester, of 400–600 tons of coal in the course of a year.

It would be most instructive if a complete survey of the effect throughout the country could be made so that the resultant approximate actual saving in fuel could be estimated. The measure has been carried out with relatively little inconvenience, and may be permanently adopted after the war. At the present time, therefore, we should be prepared by gaining as full information of its effects as possible. Such an inquiry should not be confined to the actual fuel saving. It would be useful to ascertain if the change in habits of the people had been on the whole beneficial, and the effect of the measure on conditions of work in factories and offices. If it could be shown that the percentage of absentees through sickness had been materially diminished, this in itself would be a most important result, which would no doubt influence future decisions regarding premises into which the access of daylight is always deficient.

Associated with such an inquiry, again, is the whole question of the design of buildings with a view to maximum admission of natural light, and the comparative value of the various devices for improving the light in existing buildings (the use of prismatic glass, mirrors, &c.). As a measure of economy such devices, which prolong the hours during which artificial light is not needed, deserve much more scientific study than they have yet received in this country. These problems have an important relation to the work of the Committee of the Society on Natural Lighting in Schools, which was summarised in a report issued shortly before the war, but has not since been carried further owing to lack of funds.

Mr. F. W. Willcox has pointed out the need for an accurate comparison of the initial cost of making special provision for daylight in buildings, such as specially designed windows, and the consequent extra internal heating to maintain the correct temperature. An equally important matter is the diminution in daylight caused by the practice of obscuring skylights, &c., in order to comply with the lighting regulations. It is stated that it could be shown, what is probably the case, that the cost of providing efficient blinds, which could be drawn down in the evening and released in the day, was small in comparison with the running saving in artificial light so caused, this in itself would be an important result.

ECONOMY IN ARTIFICIAL LIGHT.

I come next to the question of economy in artificial light. The national importance of economising in fuel supplies has led the Board of Trade to issue circulars requesting consumers to diminish their consumption of gas and electricity for lighting, and inviting gas and electrical supply companies to co-operate in bringing about a 10 per cent reduction. This matter was referred to in a recent editorial in the *Illuminating Engineer*.

It was stated then, what I am sure will meet with general agreement, that judicious economy in lighting, by which is meant prevention of the waste of light, and its application in practice in the most efficient manner, is one of the main objects of our society. The advice widely placarded on the official notices throughout London "Don't waste coal, gas or electric light" meets with our full approval.

It is, however, necessary to supplement this advice by more detailed instructions as to how this waste can be avoided; and here our society, which is constantly engaged in studying the proper methods of using light, is already doing national service. If the advice contained in the little pamphlet issued in 1913, entitled "Light and Illumination: Their Use and Misuse," were generally followed a very large saving, accompanied by an improvement in the conditions of illumination, would be at once secured.

On the other hand, we have abundant evidence that the mere diminution of illumination, in cases where it is even at present insufficient for the purpose in view, is false economy. I have so frequently referred to the conclusions of the Home Office Report on Factory Lighting that good illumination is essential in factories and workshops, and that defective illumination leads to diminished output, spoiled work, and an increased number of accidents, that it seems hardly necessary to go over this ground again. I should like to mention, however, that these conclusions are strongly endorsed in the series of bulletins issued by the Committee on the Health of Munition Workers during the present year, particularly in No. 9, relating to ventilation and lighting of munition factories, and No. 15 just issued on the effect of industrial conditions on eyesight. No one at the present moment would think of handicapping our munition factories by restricting the supply of gas or electricity, either for power or for lighting, and the same applies to all productive work, both from the economic and hygienic standpoints.

A well-considered scheme of economy, therefore, can be made effective only through the systematic education of people to appreciate the proper use of light, and the authorities would greatly assist the objects they have in view if they were to make use of this society to prepare definite instructions on the subject to various classes of the community.

I may say that I have reason to believe that suggestions from us in the proper quarter would receive sympathetic consideration.

The education of the public as to what constitutes good lighting is a most important duty at the present time; and the technical Press, which has so widely noticed our work since the commencement of the illuminating engineering movement, can do good service by keeping this matter constantly before the notice of their readers.

WASTED LIGHT.

Meantime we have before us every day many examples of wasted light. We see lamps in shop windows shrouded with coloured paper or obscuring lacquer so that a mere fraction of the light produced is allowed to penetrate through the screen and carry out any useful purpose. In interiors we see old and wasteful types of lamps still employed, or lamps used without any adequate form of shade or reflector, throwing a large part of the light where it is not required.

One difficulty which one meets in making economies is that of obtaining a proper supply of the best types of reflectors. The shortage is presumably due largely to the exceptional demands of munition factories, and to limitations in manufacturing facilities or material. Some members may be able to make suggestions on this point. It may be that this is a case in which we have to submit to present inconveniences, but it should be clearly understood that this is in no sense an economy. The cost of installing proper lighting appliances is small in comparison with the saving over a number of years in gas or electric consumption, not to mention the effect of unsatisfactory lighting on the output and quality of work.

Anything that can be done to encourage the development of lighting appliances of which we are lacking would be in the nature of an investment, since the life of such appliances is certainly much in excess of the lamps with which they are used. It would be interesting if makers could give approximate particulars of the life of reflectors of various

* From an address delivered at a meeting of the Illuminating Engineering Society held on the 15th inst.

kinds under average conditions; if they would state what can and is being done to collect and renovate reflectors which, on account of surface deterioration, would otherwise be scrapped; and what other available materials could be suggested from which useful shades for temporary use could be made.

Assuming the need for economy, we are still in want of more definite information on the intensities of illumination actually required for various processes. This point was discussed at the time of the issue of the Home Office Report, and it will be recalled that in the American Code on Factory Lighting a rough classification of the illumination needed for safety and convenience, and for rough and fine manufacturing operations, was attempted.

So far, however, there has not been an exhaustive scientific investigation, based on actual results achieved with varying amounts of illumination. It is common knowledge that, with the introduction of more powerful lamps during the last ten years, the standard of illumination in interiors has steadily risen. There is good ground for thinking that this progressive change is well justified, and that the order of illumination prevailing in the days of carbon filament electric lamps and flat flame gas burners was often too low for modern strenuous work. In many instances it was certainly under a foot-candle.

AN AMERICAN EXPERIMENT.

Yet, from the standpoint of economy, it would be very important to determine the approximate upper limits, beyond which no gain in output or quality of work is to be obtained. A most instructive experiment is being conducted by the Commonwealth Edison Company in the United States. A factory is being lighted in accordance with the best modern practice, and arrangements are being made for increasing at will the illumination to three times its present value. The experiment will be carried on for at least four months, the two methods of lighting being used alternately at intervals of a month, and a careful check of the output and quality of work kept throughout the entire period.

Now, the Committee on the Health of Munition Workers has been carrying out many detailed investigations into the effect on output in munition factories of changing hours of work; and similar researches undertaken in France, and described in the Chadwick Lectures recently delivered by Prof. William Stirling, showed beyond doubt that if the hours of work are increased past a certain point the output first becomes stationary and ultimately falls off.

Illuminating engineering in relation to factories should be regarded as an important branch of the admirable "Welfare Work" carried out under the Ministry of Munitions, with which it has much in common. From the commencement of the movement we have regarded illumination as a necessity in modern life, and inquiry into its proper use as a public service. This idea was emphasised in the closing words of Prof. Silvanus Thompson's inaugural address to the society in 1909. We have found, too, as those engaged in the welfare movement have found, the necessity for patient education of public opinion through our meetings and through the scientific and technical Press. It would be most instructive if, while detailed investigations into other variations in conditions affecting the health and efficiency of munition workers are being made, the influence of changing conditions of lighting could also be studied.

LIGHTING CONDITIONS IN THE STREETS.

I come now to another aspect of economy in lighting—namely, the diminished illumination in the streets. I wish to make it clear, as I did when this matter was first mentioned at the opening meeting of the society in the autumn of 1914, that we are all willing to abide loyally by any conditions demanded in the interests of the safety of the country, and I do not mean to discuss this matter in relation to precautions which the authorities consider necessary with a view to minimising the danger from hostile aircraft.

At the same time we cannot help being conscious that, if the assistance of those who have made a study of illumination for years were more effectively utilised, it might be possible to improve on the present arrangements in many respects—to make economies that would be very desirable at the present moment, and to provide conditions of illumination which, while meeting the views of the authorities, would make the streets more tolerable for traffic and pedestrians.

One fact that has been strikingly brought out is the increase in the number of accidents due to motor vehicles which, for the years 1913 to the present time, were stated in the House, in reply to a question by Mr. Gilbert, to be as follows:—

Year.	Fatal accidents.	Non-fatal accidents.
1913*	424	13,153
1914	493	14,638
1915	666	16,366
1916 (to October 31st)...	509	11,827

This increase has taken place in spite of a number of factors which should tend to diminish accidents, such as the diminution in the number of people and vehicles in the streets, the slower speed of traffic, the greater care exercised by drivers and pedestrians, and the tendency to greater sobriety since the outbreak of war.

The relation between diminished illumination and accidents therefore deserves careful study, and the following additional information would furnish useful data for drawing conclusions on this matter:—

(1) The returns of the accidents during *each month* of the period referred to above.

(2) The respective numbers of accidents in each month during the day, and between sunset and sunrise.

(3) The dates at which further restrictions in lighting have been introduced.

(4) The approximate figures for the number of licensed motor vehicles, tramcars, &c., plying in London in each month.

(5) The dates at which restrictions, if any, in the speed of such vehicles have been introduced.

The importance of the matter was emphasised at the conference called by the London General Omnibus Company on Friday, December 1st, with a view to forming a "Safety First" Campaign Council for the Metropolitan area. Mr. Blain, the operating manager of the London General Omnibus Company and the originator of the conference, explains that the movement had its origin in a general desire to promote safety in the streets even before the present darkening took place. The present conditions, however, make the movement especially welcome, and it is not surprising that at the meeting most of the speakers referred to the anomalies in the treatment of lighting in different districts.

There are many different aspects of the subject to be considered. In addition to the question of accidents, there is the choice of methods of dimming the lights which will waste as little gas and electricity as possible. There is also the question of accidents, referred to above. And there is also the very important consideration that the mere slowing down of traffic (in some streets to a walking pace) is, especially at busy times of the day, a great economic loss.

The recent fog in London, and its attendant inconveniences, led to the lighting conditions being much discussed in the Press; and many suggestions, more or less practicable, have been made; for example, that two alternative systems of lighting should be provided, so that in the event of a fog the illumination can be temporarily increased, the provision of special red lamps on refuges, and the more general whitening of the kerbs and other obstacles.

SCIENTIFIC DARKENING.

It is evident, however, that the greatest measure for the safety of the streets would be the more scientific darkening of the lights. One undesirable feature of the present arrangements, to which attention was called in the discussion of the society in 1914, is the extreme "patchiness" and uneven distribution of light, giving rise to severe contrasts of light and darkness. There seems reason to believe that this inconvenient effect has not been deliberately sought for any purpose, and that it is merely the accidental result of the crude methods of shielding the lights now being employed. One of the first points to receive attention in a scientific inquiry would doubtless be the elimination of these severe contrasts in light and shade, which are distracting alike to drivers and pedestrians, and are probably not desirable, as forming distinct marks on the roads when viewed from above. The great variety in method prevailing in different districts apparently arises through the fact that a number of different authorities are concerned with the matter, whose directions are often more or less conflicting. In addition, it would appear

* Taken from the Returns on Street Accidents caused by vehicles during 1913, presented to the House of Commons February 26, 1914 (not stated in the House).

from the results that the actual measures taken are often decided by people who have little experience of lighting problems, and do not appreciate the great difference in convenience occasioned by apparently small variations in procedure in dealing with public lamps.

There have been many unprecedented "linking-up" measures, many of which would have been considered impracticable in peace time. Now that the darkening of London has been experienced for over two years, is it not time for a comprehensive inquiry to be made, and for the establishment of a central authority to deal with the matter, taking into account *all* the various aspects of the matter, and bringing about greater uniformity in the measures taken throughout London and possibly throughout the entire country? I believe that in this way it would be possible, not only to get better results from the standpoint of the public safety, but to make a very considerable saving in gas and electric consumption. Many of the present methods, which involve darkening almost the entire surface of the globe of a powerful lamp, are most unscientific and uneconomical, and at present there is apparently nobody whose duty it is to see that better methods are adopted.

Gas and electric supply companies are, to a great extent, tied by their existing contracts, and neither they nor the borough councils are inclined to embark on rearrangements of lighting systems which may afterwards be vetoed. They are also perplexed by their efforts to meet the wishes of various authorities, some of whom consider the interests of traffic, others economy in lighting, others only precautions against hostile aircraft, but none supplying a definite specification stating how *all* these requirements can be most economically and efficiently met.

Our society, which numbers among its members engineers concerned with both gas and electric supply, makers of lighting appliances, and experts in touch with various Government departments, and which has made a special study of lighting problems and the compromise between different aspects of lighting which they involve, should be in a particularly favourable position to give assistance in this matter.

MUNICIPAL SCHEMES AFTER THE WAR.

HARROGATE T.C.—The Highways Committee have prepared schemes for wood paving, and road diversion and widening. The Health Committee recommend the provision of a refuse destructor and the duplication of a cast-iron syphon on the south outfall sewer. It is also proposed to build a new bandstand in Crescent-gardens. The General Purposes Committee's proposals include new shops and lavatory and storage accommodation at the market hall. The Lighting Committee recommend a new bridge to the works, 15 ft. higher than the present one, and raising the road level to the coal bunkers and moving weighbridge. It is also proposed to construct a new reservoir above the works; a new road along the bottom of the field from Ripon-road; and new boilers, pumps, coal bunkers and accessories. The Water Committee recommend the division of Harlow Hill reservoir, and new water supplies to several districts.

PERTH T.C. The burgh surveyor, Mr. R. McKillop, has submitted proposals for widening the Glasgow road bridge, laying asphalt on several streets, and the widening and improving South Methven-street.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

APPLICATION FOR LOAN.

Halifax T.C.—£4,200 for the construction of sewers.

LOANS SANCTIONED.

Derby T.C.—£5,000 for electricity mains, and £1,000 for motors.

Southend T.C.—£1,175 for the restoration and repair of Leigh cliffs.

LOAN REFUSED.

Aylesbury U.D.C.—£6,500 for electricity extensions.

WILTSHIRE MAIN ROADS UPKEEP.

COUNTY SURVEYOR'S APPEAL FOR AN ASSISTANT ROAD SURVEYOR.

At the Wilts Appeal Tribunal, recently (the *Wiltshire Times* reports), the county surveyor, Mr. J. George Powell, appealed for renewal of exemption for Arthur Oldham Crew (41, married), assistant main roads surveyor under the county council, who is passed for general service.

Mr. Powell said his appeal was first for national and secondly for county interests. The area over which Mr. Crew had charge of the roads was used very much by the military at present, and would probably be in the future. Mr. Crew did a great deal of work on the roads for the military, amounting to £6,000 or £8,000 in the last eighteen months.

The chairman (Mr. A. M. Dunne): Are these roads looked after by the military or by the county?

Mr. Powell: By the county at the requisition of the military.

Mr. Powell proceeded to state that in the year ending March 31st last they had suffered on account of not being able to do the work on account of the lack of men and team labour, and inability to get material delivered. They were now in a much worse position as regards material than they were twelve months ago, having a deficiency of 21,000 tons instead of 12,000 tons.

The chairman: That doesn't affect Crew personally.

Mr. Powell: This work is on our hands. We are in rather a serious position in respect of certain roads. Mr. Crew has some thirty contractors under his charge, and forty to forty-four men.

The chairman: What would be the possible alternative if Crew went?

Mr. Powell: I have nobody on my staff who could replace him. He has been the whole of his life on this kind of work, and is an energetic and capable surveyor. He might possibly make a good soldier, but he would have to be trained and tried. Here he is engaged on partly national work, and I think the comparison between what he can do here and what he might do if he went to the Front is very much in favour of his staying at home.

Mr. Bell: If this man's work is so important the Government could badge him, couldn't they?

Mr. Powell: I presume they could.

Captain Morley: He has had exemption since May, has no children, and is passed for general service. Have you tried to get anybody to take his place?—No. I have made inquiries, but I have no man in my employment or in the county's service able to do this work.

The chairman: What is your own position?—because at the last hearing the reason why we let the matter stand over was because we understood there was a possibility of yourself having to go to France, and, of course, if you are remaining here the position of Crew is very different than if you were going away.

Mr. Powell: I can say nothing definite on that point. I have had an offer of a certain post, but this offer has not been confirmed in writing. I heard this on the telephone about a week ago, and am told that I should hear definitely this week. The offer made is one which I may accept. I would accept any position in which I could be useful.

The chairman: In case you go, who would have to look after this work?—Crew is the only man to rely upon.

When do you suppose you will know whether you will be going or no?—I hope to know to-day or to-morrow.

The tribunal decided to adjourn the case till January 13th, at which time Mr. Powell's position could be definitely stated.

Conscientious Objectors on Highland Road Construction.—It was stated recently in the report of the Road Development Committee of the Argyll County Council that between fifty and sixty conscientious objectors were employed on the construction of the new road at Ballachulish.

Bradford Municipal Employees' Demand.—An application for an advance in wages of 10s. per week on pre-war rates has been presented to various departments of the Bradford Corporation from the National Union of General Workers, and will affect some thousands of municipal employees. The applications will be considered by the various committees and their recommendations submitted to the special War Bonus Committee.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars have reached us during the present week. Other reports will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Hove T.C.—The town council have agreed to a recommendation of the General Purposes Committee to purchase the Hove baths and laundry for £6,500. The borough surveyor, Mr. H. H. Scott, estimates that for £1,000 the baths can be made ready for use, and that the laundry, consisting of a very large building, could be used as a store by the surveyor's department.

Limavady (Co. Derry) R.D.C.—The tenders of Mr. Samuel R. Boyd, of Belfast, have been accepted for the rebuilding of five bridges which were swept away by the recent floods.

HOUSING AND TOWN PLANNING.

Dundee T.C.—The Housing and Town Planning Committee discussed recently the improvement of an area in the West Port district. It was stated that the purchase price of the property to be acquired was £35,000, the rental being £3,000, and the area extends to 1·70 acres. Mr. A. W. Paton, the chairman, said it was proposed to erect on the area municipal dwellings of one and two rooms, and the building would be supervised from a central station. The question of betterment would arise, and it would only be fair that the buildings in the locality should have a part of this. If the question of economic rent were advanced with a view to its being put on the new buildings, it must be pointed out that these could not stand such a cost. He also said it was proposed to erect a municipal model lodging-house in the area. The committee afterwards visited and inspected the site.

Edinburgh T.C.—The burgh engineer, Mr. A. H. Campbell, has prepared a report showing the number of houses vacant in the city which might be made or are suitable for dwellings in the present great scarcity of houses. There are 432 houses of two or three rooms and 906 vacant shops, but about 20 per cent only of the latter would be suitable for conversion into dwelling-houses of two or three rooms. This would give 180 houses possible from this source. On a review of the whole situation, Mr. Campbell says that this would not satisfy the immediate or the early prospective demands for housing within the city. The houses required should be on a reorganised plan to that hitherto followed, exhibiting tenement planning for the working classes at its best.

Hythe T.C.—A scheme is being considered for providing workmen's houses, at a cost of £7,500, after the war.

MOTOR TRANSPORT.

Bradford T.C.—The town council have accepted the tender of Messrs. Dennis Brothers, at £1,300, for the supply of a 75-h.p. motor turbine fire engine, with a 55-ft. lattice girder fire escape.

Carlisle T.C.—The Electricity Committee have been authorised to purchase an electric vehicle for the removal of refuse from the works and for carting work.

Salford T.C.—It has been agreed to purchase a 45-h.p. Daimler motor car for the use of the mayor, at a cost of £1,200.

REFUSE COLLECTION AND DISPOSAL.

Sandgate U.D.C.—It was reported that the cost of scavenging had increased from £320 to £550 in the last six months, due to the increased work caused by the camp and by houses occupied by the military. It was decided to make a claim upon the War Office.

ROADS AND MATERIALS.

Bagshot U.D.C.—It was reported that the roadway foreman (Mr. A. Rapley) had written stating that he had offered his services to the Surrey unit being formed for road making in France, and asking whether the council would keep open his place as foreman.—It was resolved that Mr. Rapley be informed that the council approved of his action in volunteering his services for France, but that his letter had been referred back, as all communications from him must be sent first to the surveyor. The surveyor was also authorised by the council, in the event of Rapley going abroad before the next council meeting, to promise him employment after the war, but, as it was not known what conditions would prevail at that time, they could not promise to reinstate him in his former position. The appointment of another road foreman was also left to the discretion of the surveyor.

Blackburn T.C.—It has been agreed to carry out an improvement at the junction of Maple-street and Whalley New-road.

Dublin C.C.—An instance of an unjust attack upon the chief officer occurred at the meeting last week, when Mr. T. Clarke, J.P., referred to the cases of two men who were dismissed on the eve of Christmas, one after fifteen years' faithful service to the council. He characterised the conduct of the official responsible as inhuman and cruel. "No wonder," he added, "we have Larkins springing up when such a thing is possible." The county surveyor, Mr. Collen, explained that the men in question were engaged on steam rolling, which was a special work. They were not in the same category as the roadmen, and the reason for their dismissal was simply that sufficient money had not been granted to carry on steam rolling for the year. The usual grant in recent years was £750, but this year, for some reason or other, the Rathdown Council cut it down to £500. This amount only enabled the work to be carried on for eight months, and that period expired in November, when the money was exhausted and the job stopped. It was pointed out by the chairman (Mr. P. J. O'Neill) and others that the initial error lay clearly with the Rathdown Council, as when the £500 became exhausted the county surveyor had no authority to make a call on any other fund.

Langport R.D.C.—The council have decided to ask the War Office for a draft of German prisoners for work on the roads.

Plympton R.D.C.—Mr. Young called attention to what he considered the waste of labour in sweeping village roads every week, but the surveyor said it was only part of the duties of men who assisted in highway work. It was also pointed out that it was in some instances sanitary work also, and the men were old men. Asked if dispensing with the sweeping would enable him to deplete his staff, the surveyor said, "Not by a single man." It was decided to leave the matter in the hands of the surveyor.

SEWERAGE AND SEWAGE DISPOSAL.

Halifax T.C.—The borough engineer, Mr. J. Lord, has been authorised to obtain tenders for the construction of a sewer for the drainage of the Mixenden district, and for the supply of the necessary pipes, at an estimated cost of £5,000.

Stirling C.C.—The council last week approved of a scheme for a readjustment of the sanitary administration of the central district. It provided for the northern area being placed under Mr. J. Barr, chief district sanitary inspector, with a salary of £190, and for putting the southern area under Mr. R. Goldie, the assistant, with a salary of £150. The secretary to the Forth Fishery Board wrote requesting the council to put in force the powers conferred by the Rivers' Pollution Act, and stop the pollution of the Forth. It was stated that during the early autumn large numbers of salmon, as well as eels and flounders, had been killed by the pollution. Dr. Adam, the county medical officer, stated that he had not seen in the condition of the Forth anything calling for his attention from a public health point of view. A small committee was appointed to report.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—The town council have approved a scheme for the extension of the electricity works, at an estimated cost of £3,500.

Bangor (Co. Down) U.D.C.—The surveyor, Mr. H. C. Bell, recommended that a 12-in. syphon outlet should be provided for the outlet pipe from No. 1

reservoir at Conlig, and communicated to the 9-in. and 7-in. mains, at an estimated cost of £330, and the council have decided to obtain tenders for the work.

Birkenhead T.C.—It has been agreed to pay the water engineer of the Alwen water scheme—which has been closed down by direction of the Treasury—£1,000 in January, 1917, and £1,000 in July, 1917. The balance of remuneration still to be paid to the engineers under the agreement is £6,145.

Blackburn T.C.—It has been decided to lay a 4-in. electricity main from Revidgeroad to Brentfell road.

Brunswick (Victoria) T.C.—The city council are raising a loan of £7,300, of which £6,000 will be devoted to the extension of electric lighting.

Chester T.C.—The city surveyor, Mr. W. M. Jones, has prepared alternative estimates for relaying sections of the tramway tracks.

Denby and Cumberworth U.D.C.—Approximate estimates have been prepared by the surveyor, Mr. T. Shield, for the provision of more water for the high-level supply. Two schemes are before the council, both involving pumping, in one case the water being in sight, the other subject to the success of exploration.

Dewsbury T.C.—The Waterworks Committee have accepted the tender of the Leeds Meter Company, Armley, at £135, for the supply of a water-pipe scraper.

Glasgow T.C.—The corporation have accepted the tender of Messrs. Macfarlane, Strang & Co., at £1,173, for 150 tons of small cast-iron pipes for the water department.

Goole U.D.C.—The question is being considered of an extension of the gas supply to the new shipyard at Hook.

Hammersmith B.C.—The linking-up scheme with the Fulham electricity undertaking is to be carried out at an estimated cost of £250.

Holywood U.D.C.—Negotiations are being completed for the purchases of land in connection with the water-works extension scheme. A provisional scheme of supply was proposed by Mr. Hanna, but after considering this the council decided that it was not feasible at present.

Kilmarnock T.C.—A conference is to take place with Sir Alexander Kennedy on the subject of electricity extensions.

Luton T.C.—The council have accepted the tender of the British Vacuum Cleanser Company, at £280, for the supply of the cleaning suction plant.

Redruth U.D.C.—A proposal to effect alterations to the pumping plant at the Sandy-lane station, at an estimated cost of £72, has been referred to the Water Committee.

Rhyl U.D.C.—Application has been made to the Ministry of Munitions for a licence to carry out a scheme for the provision of new filter-beds for the water supply.

Taunton T.C.—In consequence of the increasing tendency to apply electricity to domestic purposes, the Electric Committee in 1915 gave consideration to the matter of securing definite data upon which to work, and made certain arrangements with the borough electrical engineer towards that end. Under these arrangements he agreed to wire the residence he was renting and obtain and instal at his own expense the appliances necessary to conduct the house as an "electric" house. Meters were fixed to record separately the consumption for (1) light, (2) heating, (3) cooking, (4) hot water supply. Facilities were given for exhibition to prospective users of appliances, which facilities were freely used. The committee arranged that 2,000 units should be used without charge. The year's consumption for all purposes came to 5,757 units, and the committee at their last meeting decided to consider the consumption as a departmental matter, and to make no charge in respect thereof. The committee had decided, subject to the council's approval, to give the electrical engineer in future a concession in respect of his supply of electricity to the extent of 2,000 units per annum free, and a charge of 1d per unit beyond that total. The arrangement had existed for some years of supplying certain men at the works with electricity at a flat rate of 1d per unit, on the understanding that on failure of the light such men would immediately report themselves at the works for breakdown duty. The committee now proposed extending that arrangement to any of their workmen so desiring. The council approved these recommendations.

MISCELLANEOUS.

Denby and Cumberworth U.D.C.—With reference to the absence of the inspector on military duty, a letter to the council from the Local Government Board suggested filling the vacancy for the time being by appointing one man inspector for the present combined districts. The council are opposed to this policy of the Local Government Board, and the clerk was instructed to emphasise their decision to appoint temporarily for their own district.

Hartlepool T.C.—The borough engineer, Mr. A. P. Horsley, submitted plans and sections for a reinforced-concrete sand screen extending from Penrith-street to East-parade, and he was instructed to proceed with the work, subject to the consent of the landowners being obtained.

Lancaster T.C.—War bonuses of from 5 to 10 per cent have been granted to officials whose salaries do not exceed £135 per annum.

Oxford T.C.—A special committee recommend that all the workmen paid by the hour should receive a war bonus of ¾d. an hour, and that all weekly workmen should receive a war bonus of 3s. per week. An amendment was proposed that the bonus should apply only to efficient men employed at the standard rates, but this was rejected. In the course of the discussion, the city engineer, Mr. W. H. White, explained that the men paid by the hour were stopped when rain set in, or through some cause which prevented the work being proceeded with. Everyone knew the difficulty under which they were labouring. All their best men had gradually drifted away, and they were left with men who were not the best, and, of course, they did not get the same amount of work out of them. If the amendment was carried it would mean that a good many men now employed would be discharged and the work would have to drag on.

Rhyl U.D.C.—At the last meeting the surveyor, Mr. A. A. Goodall, reminded the council of the repeated warnings he had given of the serious erosion which was taking place along the coast in front of Rhyl and eastwards towards Prestatyn, and it was decided to request the clerk to inquire as to who was responsible for the sea defences outside the council's district.

Stafford T.C.—The borough engineer, Mr. W. Plant, reported that, in view of the extension of the borough in April, it would be necessary to purchase additional horses and carts, and to provide extra stable and cart-shed accommodation at the sanitary depot, and he submitted plans of a new four-stall stable, messroom, steam-roller shed, and an extension of the cart shed. The estimated cost was £759. The council have approved the plans, and also decided that work involving an expenditure not exceeding £500 be proceeded with, the Health Committee to be authorised to deal with tenders for the super-structure.

Waterford C.C.—The county surveyor has promised to prepare plans and estimates of works of sea defence at Ardmore, part of which is being destroyed by coast erosion.

Roadmen's "Starvation" Wages.—In the course of the last meeting of the Llangollen Rural District Council the surveyor said he had no report, as the men employed on the roads had declined to work for the starvation wages of £1 a week. Mr. John Roberts said that many of the men were married, and the cost of living was 9s. in the pound more than before the war, when wages were the same. A member: They have not asked for an increase. Mr. Roberts: Justice demands it. The surveyor: Or you will have no men. A war bonus of 5s. weekly was granted.

Sir J. Macdonald and Motor 'Buses.—Sir J. H. A. Macdonald, K.C.B., in the course of an address recently at Edinburgh on "Public Street Conveyances To-day," said the question for Edinburgh citizens was how could a good and efficient system of public conveyance be found which would meet public needs, be capable of extension, and at the same time do as little injury as possible to the unique beauty of the city? In advocating the free-moving motor vehicle as against the vehicle with fixed rails, he said that motor 'buses were successfully running in London, Brighton, Oxford, Eastbourne, and elsewhere. That was not the time to embark on a scheme which would require half a million of capital when a service could be provided similar to what had proved satisfactory elsewhere with an outlay on vehicles only.

FOOD PRODUCTION IN WAR-TIME.

LOCAL AUTHORITIES AND THE CULTIVATION OF SURPLUS LAND.

Last year an experiment in the direction of growing oats was made at the Birkdale, Southport, filtration area, and proved very successful. This area is to be similarly utilised next year, and in addition it is proposed to plough up and cultivate a portion of the Victoria Park and Recreation Ground—which has been very little used for its original purpose during the past twelve or eighteen months—as well as other vacant plots of suitable land. An invitation is extended to residents to make application for plots to cultivate.

BIRMINGHAM T.C.—The parks' gardeners are to help inexperienced cultivators. Probably the growing of potatoes begun by the corporation last year at two of the outlying parks will be extended.

BLACKPOOL T.C.—The corporation are taking up the question of more food, and have decided to plough and sow with some kind of grain a large open space formerly used as a recreation ground. Vacant land in other parts of the town will be laid out as allotment gardens and let at a nominal rental.

DARLINGTON T.C.—The corporation are offering about 50 acres of unoccupied building and other sites in the borough to people who are willing to cultivate them as allotment gardens. Success seems assured.

HAMPSTEAD B.C.—"We have had a number of plots of 1 and 2 acres under cultivation," said the mayor, "and we are going ahead with the scheme directly we get the land."

LEEDS T.C.—The corporation have at their disposal 168 acres of land that may be almost immediately ploughed and set apart for the growth of annual crops of foodstuffs. It is stipulated that three-quarters of each plot must be applied to the production of potatoes, and such things as fruit bushes, rhubarb, asparagus, strawberry plants, or flowers are expressly excluded. The size of each allotment will be about 300 sq. yds., and the rent is fixed at a sum not exceeding 10s. per year.

LIVERPOOL T.C.—It has been decided to advertise the fact that allotments may be had from the corporation.

MAIDSTONE T.C.—A townsman has placed at the corporation's disposal a number of acres free of charge.

MANCHESTER T.C.—Many acres of grass land are being turned over, and the Allotments Committee expect to double the number of their tenants. When the spring comes it is hoped that the city will be ringed with war-winning gardens.

MILTON REGIS (Kent) U.D.C.—The council have decided to turn the local recreation ground into allotments if sufficient townspeople are willing to put the ground under cultivation.

PETERBOROUGH T.C.—One of the recreation grounds will be immediately ploughed up into allotments, a farm motor-tractor having been recently bought for the purpose.

RICHMOND (Surrey) T.C.—Mr. Henry Sagar, town clerk, said there have been so many applications for allotments that the only difficulty will be to obtain enough ground. "We are asking the Crown for permission to break up parts of the Old Deer Park."

ST. ALBANS T.C.—There are well over 100 acres of unoccupied building land within the city boundaries, besides 6 acres of allotment ground at present without tenants. The response to public notices inviting applications for plots is satisfactory.

SHREWSBURY T.C.—The Improvement Committee have been authorised to go into the question of the cultivation of the vacant land in the borough.

SOUTHGATE U.D.C.—It has fallen to the council to claim the first use of German prisoners on the land, permission having been obtained to draw upon the civilians interned at the Alexandra Palace. About 200 acres of land have been acquired for allotments, and it is hoped before long to have 100 Germans double-digging them. The men will be escorted to and from their work, and guarded during the day by members of the local Volunteers. Payment will be at the rate of 4½d. an hour, of which the workers will claim a third.

SUNDERLAND T.C.—Several vacant pieces of land have already been taken over by the corporation for the purpose of cultivation, the sites including the whole of a football ground in the Hendon district.

SWINDON T.C.—Some of the large recreation grounds will be broken up.

WEALDSTONE U.D.C.—The council have requisitioned all the unoccupied land in their district to let out for allotments, and have decided to buy 6 tons of potatoes, which will be sold to cultivators at cost price. They have also decided to cultivate a piece of land themselves, with a view to supplying potatoes and other vegetables in small quantities to the poorest residents.

WILLESDEN U.D.C.—The council are compulsorily acquiring land which will be let to ratepayers for the purpose of food production at the nominal rent of 1s. per annum for 10 poles.

WINCHESTER T.C.—The question of exercising the statutory powers of making use of unoccupied land for the raising of produce is being considered by the General Purposes Committee.

YORK T.C.—The city council are granting facilities for the cultivation, for the production of foodstuffs, of vacant land in their possession.

PERSONAL.

Mr. J. O'Leary has been appointed surveyor to the Queenstown Urban District Council.

Mr. W. G. Mathias, surveyor to the Narberth (Pembrokeshire) Urban District Council, has resigned.

Mr. G. R. Shield, highway surveyor to the Haltwhistle Rural District Council, has offered his services in connection with the road making scheme in France.

Mr. W. H. Filer has been appointed surveyor and sanitary inspector to the Lexden Rural District Council, in succession to the late Mr. J. Ennals.

Mr. R. G. Gurney, surveyor to the Ledbury Urban District Council, who has been gazetted Captain in the Herefordshire Regiment, has volunteered for road service in France.

Mr. L. Roseveare, borough engineer of South Shields, has accepted service with the Road Making Battalion in France, with the rank of Captain in the Royal Engineers.

Mr. Arthur G. Bradshaw, F.S.I., borough surveyor and water engineer, Lancaster, has been given an appointment with the rank of Captain in connection with the road reconstruction and reorganisation scheme in France.

Mr. F. Harper, surveyor and inspector to the Hardingstone rural district, has been appointed to act also as surveyor and inspector to the Northampton Rural District Council, during the absence of Mr. G. Willcox on military service.

Temporary Major J. Wightman Douglas, R.E., who has been awarded the D.S.O. for gallantry and devotion to duty in the field, is the second member of the Society of Architects serving in that branch of the Army to receive this distinction during the present war. Major Wightman Douglas supervised the wiring of the whole line under heavy fire, and set a splendid example of courage and determination throughout. Major Wightman Douglas is an architect practising in Newcastle-on-Tyne.

Lord Cowdray, better known as Sir Weetman Dickinson Pearson—who has been made by the King one of the three Viscounts created on the occasion of the resignation of Mr. Asquith as Premier—is the head of the great firm of S. Pearson & Son, contractors, which was associated with such undertakings as the building of the Blackwall Tunnel and the enormous graving docks at Halifax and Nova Scotia. It has been said of him that he could "turn stone into gold by compelling Nature to yield."

OBITUARY.

Mr. Thomas H. Pilkington, for many years assistant county surveyor of Clare, died on Saturday last, we regret to state. He had also held the post of secretary to the Fergus, Innis, and Sixmilebridge Drainage Board.

Colonel George Albert Hutchins, M.INST.C.E., county surveyor of Montgomeryshire, died, we regret to state, on the 19th inst. The youngest son of the Rev. R. W. Hutchins, rector of East Bridgeford, Notts, he was educated at Magdalen College, Oxford, and had a versatile career, serving in a professional capacity in India and South America, editing the *Carmarthen Journal*, and publishing articles on "Tactics" and other military subjects. He was an expert shot and won many prizes at Bisley.

INSTITUTION OF MUNICIPAL ENGINEERS.

President.—Mr. HENRY C. ADAMS, M.INST.C.E., M.I.MECH.E., F.R.S.A.I.

Hon. Secretary.—Mr. EDWARD WHITWELL, F.I.S.E., M.S.A., Engineer and Surveyor, Aberystwyth Urban District Council. (Local R.N.V.R.)

ANNUAL MEETING.

The general annual general meeting is to be held in London on Saturday, January 6th.

PROGRAMME.

11.30 a.m. Council meeting.

11.45 a.m. Meet in the council chamber, No. 1 Southampton-row, W.C.

12 o'clock. Annual general meeting.
Minutes of last annual general meeting.
Presentation of annual report of council.
Announcement of result of ballot for election of president and council for the year 1916-17.
Installation of president.
Any other business.

12.45 p.m. Adjourn for lunch.

2.30 p.m. Re-assemble in council chamber.
Presidential address.
Discussion on the following papers to be presented to the meeting:
"A *Resumé* of Public Health Matters," by G. Belson Clayton, M.R.San.I. (Member).
"Practical Road Work," by Geo. Rodley (Member).
"Notes on the Use of Electricity in Municipal Engineering," by Horace Bool M.I.E.E., M.I.MECH.E. (past-president).

B. WYAND,
Secretary.

39 Victoria-street, S.W.

APPOINTMENTS VACANT.

OFFICIAL AND SIMILAR ADVERTISEMENTS RECEIVED UP TO 4.30 P.M. ON THURSDAYS WILL BE INSERTED IN THE FOLLOWING DAY'S ISSUE, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* WEDNESDAYS *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (City No. 1046) subject to later confirmation by letter.*

TEMPORARY ENGINEER SURVEYOR AND INSPECTOR.—Junior 6/1 Street Urban District Council. £175 per annum. Mr. S. F. Clothier, clerk, Council Offices, Street.

CHIEF WATER INSPECTOR.—January 8th.—Corporation of Doncaster. £150 a year.—Mr. R. E. Ford, acting water engineer, Mansion House, Doncaster.

SURVEYOR AND INSPECTOR OF NUISANCES.—January 8th.—Cheriton Urban District Council.—Mr. Arthur Adamson, junr., acting clerk, Permit Offices, Cheriton, Kent.

SURVEYOR AND INSPECTOR.—January 15th.—Dorking Urban District Council. £250 per annum.—Mr. W. J. Hodges, clerk, 64 South-street, Dorking.

TEMPORARY BOROUGH SURVEYOR.—January 13th.—Corporation of Middleton.—Mr. J. P. Walmsley, town clerk, Town Hall, Middleton, Lancs.

ASSISTANT ENGINEERS.—March 31st.—Indian Public Works and State Railways Department. Not less than twenty-one and not more than twenty-four years of age on July 1st.—The Secretary, Public Works Department, India Office, London, S.W.

CITY ENGINEER'S SECRETARY.—Box 1,598, THE SURVEYOR, Office, 24 Bride-lane, Fleet-street, London, E.C.

ASSISTANT ENGINEER.—Public Works Department, Straits Settlement. £300 x 15 £480.—Messrs. Gregory, Eyles & Waring, 12 Dean's-yard, Westminster, S.W.

MUNICIPAL COMPETITIONS OPEN.

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LEON (Spain).—August 15, 1917.—Schemes are invited for a water supply, and also for the improvement of the sewerage system. A prize of £1,000 will be awarded to the author of the selected scheme.—Secretaria del Ayuntamiento, Leon, Spain.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

PEMBROKE.—January 2nd.—For cement plastering work on various cottages, for the urban district council.—The Town Hall, Ballsbridge, co. Dublin.

Engineering: Iron and Steel.

SCUNTHORPE.—January 3rd.—For the supply of the electric motor and pumps constructed, the latter required to deliver 3,000 gallons per minute on a lift of 60 ft., also a transformer, for the urban district council.—Mr. Herbert Heap, engineer and surveyor, Council Offices, High-street, Scunthorpe.

DURBAN.—January 3rd.—For the supply of a 2,000-kw. steam turbine, alternator and condensing plant, for the corporation.—Borough Electrical Engineer, Municipal Buildings, Durban, South Africa.

CAPE TOWN.—January 5th.—For the supply of electric motors and starting panels, for the corporation, Electricity Department, Dock-road, Cape Town.

WIGAN.—January 8th.—For the supply of a 30-h.p. motor boat winch for the Tramways Committee.—Mr. F. Buckley, general manager, Corporation Tramways, Market-place, Wigan.

ALNWICK.—January 8th.—For providing and fixing four sluice valves, for the rural district council.—Mr. H. W. Walton, clerk, Alnwick.

SYDNEY.—January 8th.—For the supply and erection of pumping machinery in two units, driven by suction gas or by steam, for the Iverell water supply, for the New South Wales Department of Public Works.—Department of Commercial Intelligence, Basinghall-street, E.C.

AUCKLAND (New Zealand).—January 21st.—For the supply of mild-steel or iron gates and bearing, for the Harbour Board.—Messrs. W. & A. McArthur, Canberra House, 18-19 Silk-street, Cripplegate, London, E.C.

Roads.

RUISLIP NORTHWOOD.—January 1st.—For the supply of 4-in. washed granite chippings, and tar-spraying, for the urban district council.—Mr. Edmund R. Abbott, clerk, Council Offices, Oaklands Gate, Northwood.

ROMFORD.—January 1st.—For the supply of broken granite, for the rural district council.—The Highway Surveyor.

TWICKENHAM.—January 3rd.—For sewering, levelling, kerbing, paving, channelling, and making good part of a street, for the urban district council.—Mr. Fred W. Pearce, surveyor, Town Hall, Twickenham.

BOURNE.—January 6th.—For the supply of 5,000 tons of granite, and 1,000 tons of slag, for the rural district council.—Mr. T. Lake, district surveyor, Bourne.

NORTH RIDING.—January 10th.—For team labour and hauling clay work, and by tonnages, and for macadam and stone rolling, for the county council.—Mr. W. G. Bryning, county surveyor, County Hall, Northallerton.

SPILSBY.—January 12th.—For the supply of 4,000 tons of broken granite, 8,000 tons of broken slag, and 500 tons of slag chippings, for the rural district council.—Mr. W. Cooke Brackenridge, district surveyor of highways, Spilsby.

DURHAM.—January 13th.—For tar-spraying on the main roads, for the county council.—Mr. Albert E. Brookes, county surveyor, Shire Hall, Durham.

SOMERSET.—January 20th.—For steam rolling and carrying, for the county council.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

SOMERSET.—January 20th.—For the supply of broken granite or basalt, for the county council.—Mr. Gordon R. Folland, acting county surveyor, Wells, Somerset.

WORCESTERSHIRE.—January 20th.—For the supply of granite, blast-furnace slag, and tar-macadam, for the county council.—Mr. C. F. Gettings, county surveyor, 30 Foregate-street, Worcester.

Stores.

DESBOROUGH.—January 8th.—For the supply of tar-macadam, broken granite, slag, gravel, sanitary pipes, blue bricks and pavers, and Portland cement, for the urban district council.—Mr. W. Marlow, surveyor, Council Offices, Desborough.

HORNSEY.—January 8th.—For the supply of road materials, paving, granite and general mason's materials, mason's and pavior's work, Portland cement, bricks, iron and steel, disinfectants, and carriage, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor, Town Hall, Southwood-lane, Highgate, N.

PLYMOUTH.—January 15th.—For the supply of paints, varnishes, ironwork, petroleum oil, broomheads, household brushes, rope, iron and steel, pitch-pine, deals, flooring, carbolic powder, Portland cement, lubricating oils, tar and pitch, painter's brushes, explosives, soap, wood blocks, creosote, disinfectant fluid, granite kerbs, setts, white lead, red lead, linseed oil, turpentine and turpentine substitute, refilling machine revolving brooms, benzoline and motor spirit, tools, indiarubber goods, hose, and ship chandler's goods, for the corporation.—Mr. James Paton, borough engineer and surveyor, Municipal Offices, Plymouth.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BOYTON.—For the supply of 100 to 500 tons of non-slippery granite setts, for the urban district council.
Newry Granite Company, Newry.
North Wales Granite Company, Middleton.
* Brookes, Limited, Langdale.
J. V. Smith & Co., Embleton.
H. L. Cooper & Co., Clee Hill.
W. & J. Glossop, Lembton.
Shieve Donard Grey Granite Company, Shieve Donard Grey.
Summerfield Lane Co., Rathfeny.
Wettern Brothers, Limited, Dalbeattie.
Enderby and Stoney Stanton Granite Company, Limited, Enderby.
Penmaenmawr and Welsh Granite Company, Limited, Penmaenmawr.
Pwllheli Granite Company, Gimlet Rock.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY

3 Institution of Sanitary Engineers: Presidential Address. Caxton Hall, Westminster, 7.30 p.m.

6 Institution of Municipal Engineers: Annual Meeting, 4 Southampton-row, London, W.C.

APPOINTMENTS OPEN.

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CHERITON URBAN DISTRICT COUNCIL.

APPOINTMENT (TEMPORARY) OF SURVEYOR AND INSPECTOR OF NUISANCES.

The Urban District Council of Cheriton invite applications from gentlemen willing to act during the war as Surveyor and Inspector of Nuisances, subject (as to the latter office) to the approval of the Local Government Board.

Applicants who will understand that they are asked to take the place of the Official who is away on military service) must be ineligible for military service. They must have efficient knowledge of Sanitary matters and Sewerage Works, and be fully competent to carry out the duties usually appertaining to the respective offices, including those of a Hackney Carriage Inspector, and those specified in any By-laws in force within the Urban District, and also the duties under the Dairies, Cowsheds and Milkshops Order, the Factories and Workshops Act, the Housing and Town Planning Act, and the duties of Petroleum Inspector, &c.

The area of the District is about 1,179 acres, with about 9 miles of roads, and a population of 7,577. The Main Roads are not under the Council's jurisdiction.

Applicants must be prepared to spend their whole time, if appointed, in the duties of their office. Private practice might be allowed with special leave of the Council. The successful candidate will be required to give the usual bond, the premium on which will be paid by the Council, and to enter into a written agreement with the Council.

Applications (endorsed "Surveyor"), stating age, experience, and salary required, with copies of not less than three recent testimonials (which will not be returned) as to character and competency, must be made in candidate's own handwriting, and sent so as to reach the undersigned not later than the 8th day of January, 1917.

Canvassing Members of the Council will disqualify.

NOTE.—The salary at present authorised by the Local Government Board for Inspector of Nuisances is £105.

(By order of the Council)
ARTHUR ATKINSON, JUNR.,
Acting Clerk.

Public Offices,
Cheriton, Kent. (3,201)

BOROUGH OF DONCASTER.

WATERWORKS DEPARTMENT.

The Corporation invite applications from suitable persons for the position of Chief Water Inspector. The appointment is a permanent one. Salary at the rate of £150 per annum.

Particulars of duties can be obtained from the undersigned, to whom applications must be delivered not later than the first post on Monday, the 8th January, 1917, endorsed "Chief Water Inspector," and which are to be accompanied by copies of not more than three recent testimonials. Canvassing will be a disqualification.

R. E. FORD,
Acting Water Engineer.

Mansion House,
Doncaster.
December 22, 1916. (3,215)

BOROUGH OF MIDDLETON.

TEMPORARY BOROUGH SURVEYOR.

The Town Council invite applications from Surveyors experienced in the work of a Municipal body, and ineligible for military service, who are prepared to devote whole or part-time service, and take control of the Surveyor's Department of the Corporation during the period of the war.

Sealed applications, stating age, qualifications and experience, whether for whole or part time, and salary required, together with copies of three recent testimonials, endorsed "Surveyor," should be addressed to the undersigned, and delivered not later than 13th January, 1917.

J. P. WALMSLEY,
Town Clerk.

Town Hall,
Middleton, Lancs. (3,216)

SECRETARY. City Engineer desires the temporary services of a Secretary experienced in all departments of Secretarial work, good organiser, stenographer, and typist; experienced in the nomenclature and routine of a Municipal Engineer's Department, or equivalent work, and not liable to naval or military service. Applications must be in candidate's handwriting, accompanied by references or copies only of testimonials; state desired salary, and when duties can be commenced.—Address to Box No. 1,598, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (3,217)

TENDERS WANTED.

SOMERSET COUNTY COUNCIL.

TENDERS FOR STEAM ROLLING.

Tenders are invited for Steam Rolling and Scarifying on Main Roads in the Long Ashton Division during the year ending 31st March, 1918.

Specifications and Forms of Tender may be obtained from the undersigned, to whom Tenders, endorsed "Steam Rolling," must be delivered not later than 20th January, 1917.

The Council do not bind themselves to accept the lowest or any Tender.

GORDON R. FOLLAND,
Acting County Surveyor.

Wells, Somerset.
December, 1916. (3,211)

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The Surveyor and municipal engineer

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